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The Sellers 16-ft. Planer

SPECIAL CORRESPONDENCE

The present day requirements of shipbuilders are for some very large machine tools—so large that for transportation by rail, the principal members must be made of two or more pieces—and this calls for extra care in designing so that the machines will maintain their alignment.

THE planer illustrated in Fig. 1 weighs nearly half a million pounds and was recently completed by William Sellers & Co., Inc., 1600 Hamilton St., Philadelphia, Pa., for a large shipbuilding company.

The bed is made in three sections, a central one to which the uprights are bolted and which carries the driving shaft and pinion, and two end sections bolted to the central one with taper bolts.

The bed is of open top and bottom construction, the safety guards being of heavy sheet iron fastened across the top. The main feature of the bed is its rigidity, particularly at the vital section in line with the uprights, through which the principal strains are transmitted. The absence of gearing inside the bed permits the use of uninterrupted cross members. The table is driven by the well known Sellers type of planer drive, through a spiral pinion engaging a rack on the under side of the table. The spiral pinion is mounted on a shaft which is set at an angle of 33 deg. from the center line of the bed. The pinion is about 24 in. long. This drive in action makes contact on at least four of the teeth at all times. These contacts are along different portions of each tooth and, as in the case of Herringbone gears, the resulting action is continuously smooth, there being no tendency for the shape of the teeth, on either the rack or the pinion, to wear more at one point than another. The shaft on which the driving pinion is mounted, is in two sections, which are coupled by an accurately centered jaw clutch, and clamped together to maintain the alignment. The spiral pinion is forced on one section of the driving shaft under very heavy hydraulic pressure, and the construction of the bed and the bushings on the driving shaft, permit the removal of the spiral pinion and the section of shaft on which it is forced, as a unit. The other part of the driving shaft carries at its outer end a large herringbone gear, which is also forced on the shaft in a wheel press. This gear and its section of shaft may also be removed as a unit. With the construction as above noted, the amount of room required to remove the driving shaft from the machine is minimized and the construction and installation made much easier. On the left-hand side of the machine (the side opposite to the usual operating one) the bed carries the bearings for taking the thrust of the main driving shaft in both directions. An adjustment is provided for setting up these thrust bearings, and a continuous oil bath is supplied. Around the spiral pinion is a box, open only at the top, which is used as a reservoir for running the pinion in oil.

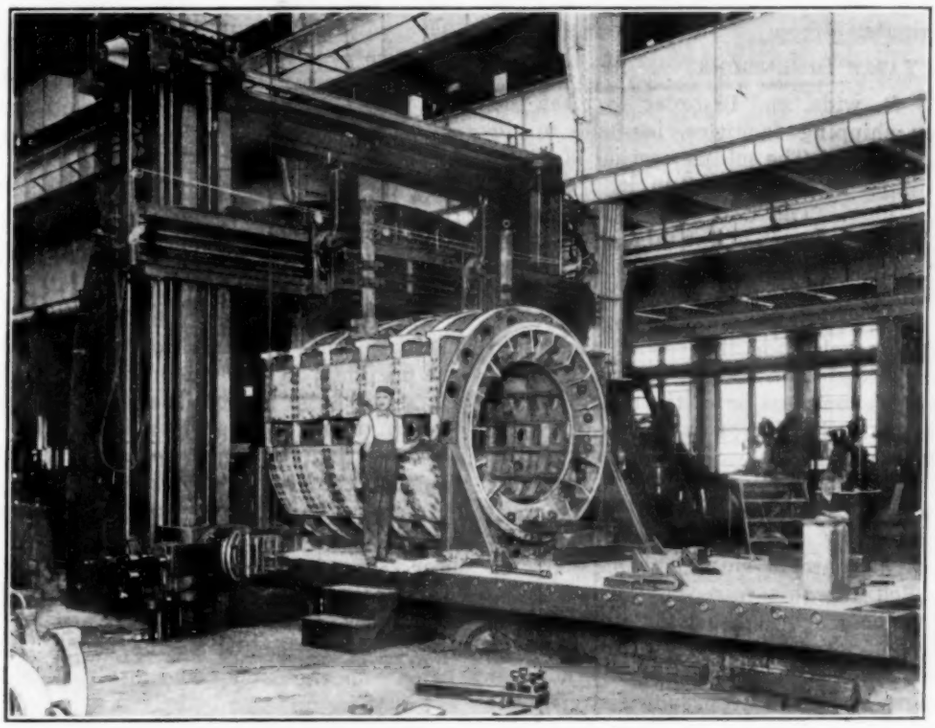


FIG. 1. SELLERS 16 x 13 x 36 FT. PLANER

Specifications: Will plane 16 ft. in width, 13 ft. in height and 36 ft. in length. Width of table, 13 ft. Uprights: width of face, 24 in.; depth, front to back, 10 ft. Cross-rail: face, 27½ in.; height, including reinforcing beam, 51 in. Table rack: pitch, 3¼ in.; face, 12 in. Weight, 412,300 pounds.

On the opposite end of the driving shaft, the main driving gear is carried in a stand or housing entirely

outside of the bed. This main stand also carries the bearings for the intermediate shaft, and the shaft which is coupled directly to the motor. As this brings all of the driving gears outside of the bed, the bearings are open to inspection and care with a minimum amount of effort. The complete driving gear train consists of two pairs of herringbone gears and the spiral pinion in the bed. The gears are completely covered and are supplied with a continuous oil bath.

The motor rests on a separate base plate, supported and aligned on the foundation of the machine and is coupled to the motor pinion shaft by a Francke flexible coupling. The motor is of the regular reversing planer type of 75 hp. capacity, having a speed range of 250 to 1,000 r.p.m. Variable cutting speeds from 20 to 40 ft. per minute are obtainable by the adjustment of a handle on the motor control. Safety devices are provided in the control panel to take care of low voltage, no voltage, overload and emergency stop. The master switch is operated by the usual type of table stops and dogs, and initiates the movement of the electrical contactors in the control panel to produce the cycle of operations of the motor. A portable pendant switch is furnished which may be used by the operator at any time, instead of the control handles, to move the table as desired. It is used mostly when setting up the work on the table. The return speeds of the machine are selective between 40 to 80 ft. per minute.

Table Dimensions

The table is 13 ft. wide, and in order to meet the limits imposed by shipping facilities, is made up in three lengthwise sections. The middle section is 10 ft. wide, and made in 2 pieces, one 18 ft. 3 in. long, and the other 20 ft. 3 in. long. The two side sections each 18 in. wide, run the whole length of the table, 38 ft. 6 in. The sections are held together by straight and taper dowel bolts, and double T-bolts and wedges. The table is provided with parallel grooves for aligning the work and with rectangular holes for the use of stops and bolts. The table is guided upon one flat and one V-bearing, the latter being a combination of the usual V-bearing of wide angle and at the sides, two surfaces inclined at 5 deg. to the vertical. These two nearly vertical surfaces are provided to resist any tendency of the table to move sideways under pressure which might be great enough to force the table upward on the V. Both the flat and the V-bearings are lubricated by oil delivered by a pump installed for this purpose only. The oil enters the ways or bearings at the middle of the bed, is forced along grooves cut on the under side of the table bearings and flows out into the open ways at either end. Drainage tanks with strainers are provided at each end of the bed. The oil is collected by them and flows through return pipes back to the reservoir provided. Catch pans are also furnished at each end of the bed for collecting the oil which may drip from the overhanging table.

William Sellers & Co., Inc., we believe, was the first user of the principle of forced lubrication for planer tables. Records show that the first use was made by that company in 1901. All planers made by it since that date have had this feature incorporated.

The cross-rail is of the extended-back type. The usual and older type of crosshead was reinforced between the uprights by a curved back, which was deepest at the middle of its length and was clamped to the front faces of the uprights. While this curved back extended the horizontal depth of the cross-rail and increased its strength in that direction, it did not increase its torsional strength which was fixed by the section at the point of attachment to the uprights. The "extended back" crosshead in contrast, is of continuous depth between the uprights and is clamped on the inside of the uprights at the back edge of the cross-rail extension, as well as to the front of the uprights on the outside. A groove is provided in each upright for clamping purposes. It can be readily seen that this construction adds tremendously to the stiffness of the cross-rail to resist torsion and also, by providing an additional tie between the uprights, adds considerably to the rigidity of the whole structure. The effect of this rigidity is noticeable in the character of work turned out with this machine.

In a cross-rail with a span of 16 ft. between supports there is usually a small amount of vertical deflection, due to the weight of the rail and saddles. This is eliminated in the machine under discussion by the application of an arched girder bolted to the top surface of the cross-rail and provided with a solid abutment at one end and a wedge abutment at the other. By setting up the wedge a practically perfect straight line is maintained in the guiding surface for the saddles.

Another difficulty caused by the length of the cross-rail, is the tendency of the screws and rods for moving the saddles to sag in the middle. To maintain their alignment, sliding bearings are used. These bearings, three in number, have an automatic latch arrangement, which insures one of them being at the center of the cross-rail at all times when neither of the saddles is at that position.

A limit switch is provided to prevent over running the crosshead when lifting.

A Pneumatic Device for Clamping Crossrail to Uprights

The general practice in building planers is to provide ordinary bolts and nuts for clamping the cross-rail to the uprights. There should be at least eight bolts on a planer of large proportions and in order to loosen and tighten them the operator has to move all over the machine, and frequently operates them under disadvantageous conditions. Considerable time is consumed whenever the cross-rail has to be adjusted up or down on the uprights, and much care on the part of the operator is required to insure that all of the clamping bolts are released or secured. On the planer under discussion, this work is done by pneumatic cylinders. These cylinders are located at the four points of clamping, namely, on the outside and inside of each upright. Each cylinder clamps two bolts.

In this pneumatic clamping device, each piston is connected to an upper clamp and each cylinder connected to and supported by a lower clamp, so that, in opening or closing, each clamp is used as an abutment for operating the one either above or below it. The four cylinders are connected by flexible hose and pipe to an operating valve within easy reach of the operator. A selective movement of the valve causes the cylinders to either open or close. After the cross-rail has been clamped the air passage may be released by the valve, as the clamps are so designed that they will not loosen until air is applied in the reverse direction. This feature is essential in a pneumatic clamp for a planer or other tool, where the length of time consumed on a single job may cover a period during which there may

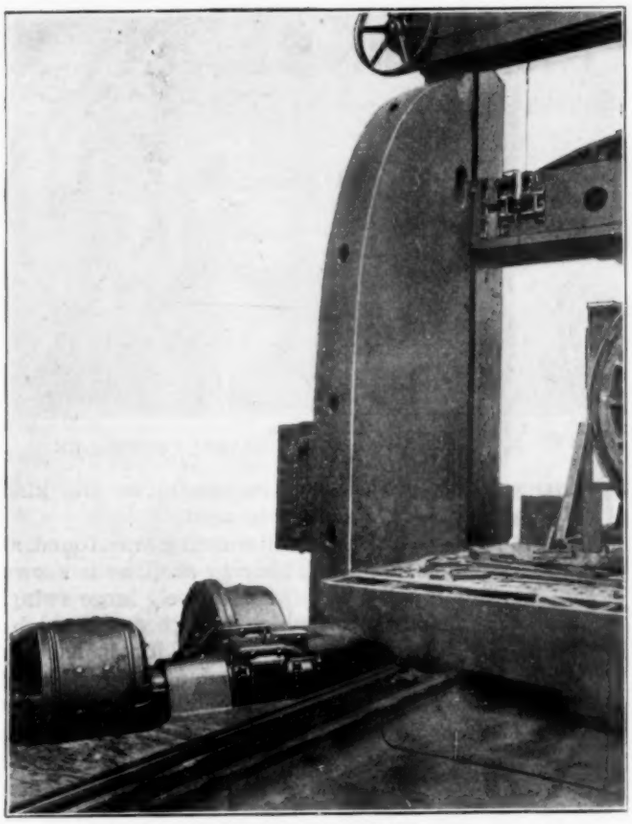


FIG. 2. DRIVING GEAR AND PNEUMATIC CLAMP FOR CROSS-RAIL

be no air pressure to maintain the clamp. If the pressure should fail even for a moment, and the clamp relax, serious results might follow.

The toolheads on the cross-rail are provided with a tool lifting device which automatically operates to hold the tools off of the work during the return stroke of the planer. They are also provided with a power traversing arrangement which moves the toolslides and the saddles. Each head is operated through an independent feed disk at the end of the cross-rail, making it possible to adjust the amount and the direction of the two sets of feeds independently.

A Sidehead Is Mounted on Each Upright

A side head of substantial proportion is mounted on each upright, and in addition to having the usual power feed up and down the upright, it has a power cross or angular feed for the tool slide. Power traversing mechanism is also provided for the side heads up and down the upright.

It is desirable that the feed motion of a planer should operate at a uniform rate of speed, irrespective of the speed of table movement. This is accomplished by the use of a separate motor, mounted on the platform at the top of the machine. This motor drives through belt and gearing to a roller feed box or escapement.

The escapement when released makes one half turn and stops. This half turn operates the slotted feed disks. The escapement is released at each end of the stroke, so that the feed may take place at one end and the reset take place at the other. The operating means between the feed disks and the heads consist of the usual type of gear segments and ratchets.

The difference between this type of feed and the commoner type operated by the driving mechanism, lies in the timing relation of the feed to the table reversal. Electrical connections are made between the table operating switch and a solenoid mechanism which trips or releases the feed mechanism. The time of release causes the feed mechanism to operate during the time taken by the table to reverse and not after the reversal as in the dependent type. Less overrun of the tool beyond the work and a consequent saving of time results.

It is also possible to disconnect the trip or releasing mechanism, from the operator's position, by the throw of a lever. A reverse motion of the lever connects the trip arrangement and re-establishes the automatic timing. When the auto feed is thrown out the table may be operated as desired with the certainty that by a single motion the feed can be resumed at the point where it was discontinued.

In Fig. 1 can be seen the reinforcing beam on the cross-rail, the rope for tool-lifting arrangement, and one line of bolts fastening the side pieces to the table.

Fig. 2 shows the driving gear arrangement at the back of the right-hand upright. The housing for the large wheel is clearly shown as well as the bolts for removing the parts necessary to uncover all of the driving gears. In the upper right-hand portion of the picture can be seen one of the pneumatic clamping cylinders, operating at the back of the extended portion of the cross-rail. The clamping slot in the upright is also clearly shown.

Driving Train Arrangement

Fig. 3 shows the arrangement of the complete driving train from the motor *M* at one end, to the main thrust bearing *B* at the opposite end.

At *A* is seen the spiral pinion for driving the table rack; at *D* is shown the coupling for the two sections of driving shaft; *L* is the long bolt for holding the two sections together; *E* and *G* are the two herringbone gears in the driving train with the mating pinions shown in mesh; *H* is a flexible coupling between the motor and the motor pinion shaft. At *C* is shown the thrust bearing used during the return movement of the

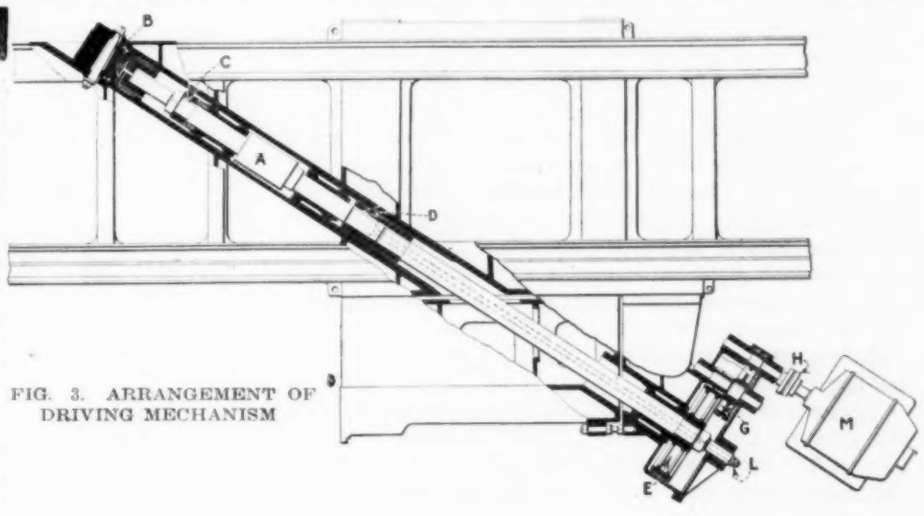


FIG. 3. ARRANGEMENT OF DRIVING MECHANISM

table. The wedge bolt in back of *B* for adjusting the steps is clearly shown. It should be noted that the provision made for the driving gear consists of a continuous hollow cylinder running diagonally across the bed, which increases the strength of the structure instead of decreasing it, as does the spur geared construction. The simplicity of the drive is evident.

Some idea of the size of this machine may be had by comparing its proportions with that of the man to be seen standing on the table in Fig. 1 and by the following weights of some of the principle members in the rough:

	Pounds
BED:	
Center section	65,400
Front section	36,000
Back section	22,000
	123,400
TABLE:	
Center section (front)	60,100
Center section (back)	53,000
Side pieces	38,000
	151,100
Right-hand upright	43,000
Left-hand upright	43,000
Cross rail	23,300
	109,300

Handling Large Work on Small Lathes

BY FRANK C. HUDSON

The usual method of blocking up headstock and tailstock did not suffice for the manager of the Pacific Machine Co., Tacoma, Wash., as a means of handling

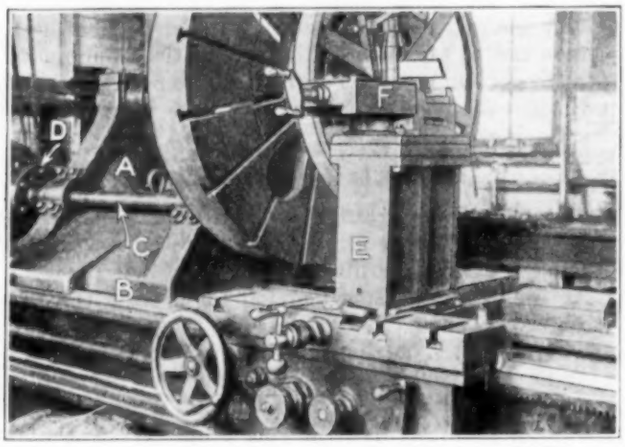


FIG. 1. AN IMPROVISED TRIPLE GEARED LATHE

the large work which occasionally came his way. So, taking an 18-in. Hamilton lathe, as a basis, he built the auxiliary triple-geared headstock shown at *A* in Fig. 1, for use on large faceplate work. This headstock is mounted in front of the regular headstock and rests on all four V's, being cut away at *B*, so as to allow the wing of the carriage to pass by when it is necessary to get the tool close to the faceplate. The shaft *C* is bolted directly to the nose of the spindle in the regular headstock at *D* and its outer end carries a pinion meshing with an internal gear on the back of the faceplate. This arrangement gives great reduction in speed and, in connection with the regular back gears of the lathe, makes a powerful pull at any of the speeds of the regular headstock.

The extension tool block *E* and the toolslide *F* bring the cutting tool up to the proper position and also give it the advantages of the compound rest for boring short holes or turning and boring tapers. This

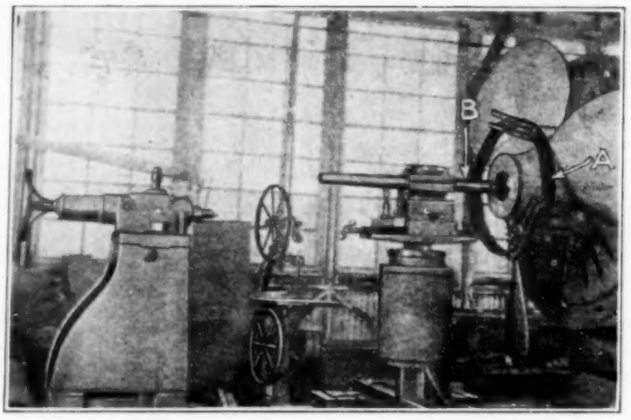


FIG. 2. BORING A THREE-BLADED PROPELLER

arrangement has proved very successful on the kind of jobbing work for which it is used.

Another case of increased lathe swing was found at the Coast Machine Co., a neighboring shop, as is shown in Fig. 2. This is a lathe of comparatively large swing, the head and tailstocks of which have been raised by blocking up in the usual manner. The job in hand is the boring of the taper hole in the hub of a three-bladed propeller. The illustration shows how the propeller is bolted to the faceplate by means of the ring *A* and the three hairpin clamps spaced about equal distances around the ring. The holding bolts go through the faceplate in the usual manner. The boring tool in the bar *B* is fed by hand owing to the taper, this being accomplished by means of the compound rest shown.

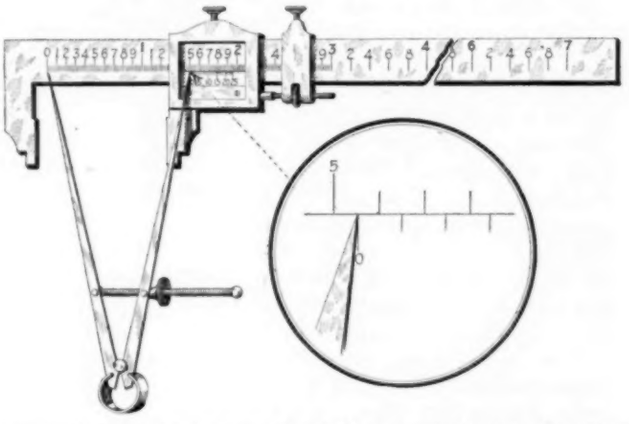
It is the unusual job of this kind that makes a repair shop interesting and gives the workers therein unusual experience in devising ways and means of handling the work and also of machining it.

Laying Off Angles Without a Protractor

BY ANTON BRUNNER

The drawing herewith shows a kink I use in laying out work that requires exceptional accuracy.

In laying off angles to minutes I employ trigonometry instead of a protractor, and as the length of a side might easily be such as to lie between the graduation marks of an ordinary scale I set my dividers by placing one point on the zero line of the bar and the other point on the zero line of the vernier, the caliper having been duly set to the required measurement.



SETTING DIVIDERS BY MEANS OF A VERNIER CALIPER

Acceleration Determinations—I

By HENRY N. BONIS, B. S., M. E.
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Following the line of reasoning introduced in his previous article the author goes on to other applications of first principles to the solution of acceleration problems. In this article he tackles the quadric chain and winds up with a general solution for the Whitworth quick-return motion as generally applied to the shaper mechanism.

IN DETERMINING the accelerations of any point of a mechanism we are sometimes confronted with a quadric chain for which the usual solutions given become indeterminate. It is one of the objects of the present article to give means of solving or evaluating these special cases. In view of the importance of the sliding joint to the designer of machinery it seems strange that more attention has not been paid to the problem of determining directly the accelerations in the quadric chain with this joint included. Aside from the special case of the slider-crank chain or steam-engine mechanism the writer knows of no book that takes up this particular problem. The only method given consists of finding a velocity-time or velocity-space curve and then determining the acceleration from this graph. It should be understood that this method depends on drawing a tangent to a curve concerning the geometrical properties of which we know nothing.

The quadric chain, when it consists only of four links and four turning pairs, can be readily solved by any one of several common constructions. In the case of constant angular velocity of the driver we have the Rittenhaus Construction. In the general case of variable angular velocity of the driver we have:

(1) Professor Mohr's Construction.

(2) The construction based upon analytical deduction where the absolute acceleration of a point of a body in uniplanar motion consists of three components, a centripetal and a tangential component about the instantaneous center and the acceleration ($\mu\omega$) of the instantaneous center. This result combined with the use of Bobillier's Construction gives the method employed in Professor Klein's book "Kinematics of Machinery."

(3) The construction based upon fundamental principles and the one that usually gives the simplest solution. (See "Dunkerly's Mechanism.")

All of these constructions can be applied to the case of constant angular velocity of the driver as well.

But when the quadric chain contains a sliding pair the above constructions do not always suffice. Referring to Fig. 1, if the links 1 and 4 become infinitely long, that is if link 4 is replaced by a sliding block, we get the slider-crank mechanism used in the steam engine and all the above constructions give a determinate result. But if link 3 is made infinitely long or reduced to a sliding block which turns about center (23) and slides on link 4 (See Fig. 3) all of the above constructions are inadequate, because the point $C(34)$ (Fig. 1), which is at an infinite distance from its center of rotation $D(41)$, has an infinite acceleration. In other words, the angular acceleration of link 4 is indeterminate from these constructions from the acceleration of point $C(34)$. There is one exception in the case of construction 2, which will be taken up in the discussion of the double quadric chain known as the Whitworth quick-return motion, as shown in Fig. 3.

In what follows the writer will give:

(1) A simple original proof of Rittenhaus' Construction.

(2) A principle by which any constant angular velocity construction can be modified to apply to the general case with application to Rittenhaus' Construction.

(3) An original construction for the general case of the quadric chain;

(4) A complete solution of the acceleration problem involved in the Whitworth quick-return motion by three different methods. In Fig. 1 we have *ABCD* as the quadric chain with *AD* or link 1 fixed, *AB* or link 2 as the driver and the constant velocity and acceleration of point *B* represented by *AB*. Construction: Draw *AF* parallel to *BC*, and *AH* parallel to *DC*. Prolong *BC* and *AD* to *Q*, and *BA* and *CD* to *P*. Join *QF* and *HP*. At points *K* and *J* erect perpendiculars to *AH* and *AF* respectively. Join intersection *O* with *H*. Then *HO* is the acceleration of point *C* in direction and magnitude. (See *Zeitschrift des Vereines Deutcher Ingenieure*, Vol. XXVII, 1883, p. 287, or Klein's "Kinematics of Machinery," p. 140.)

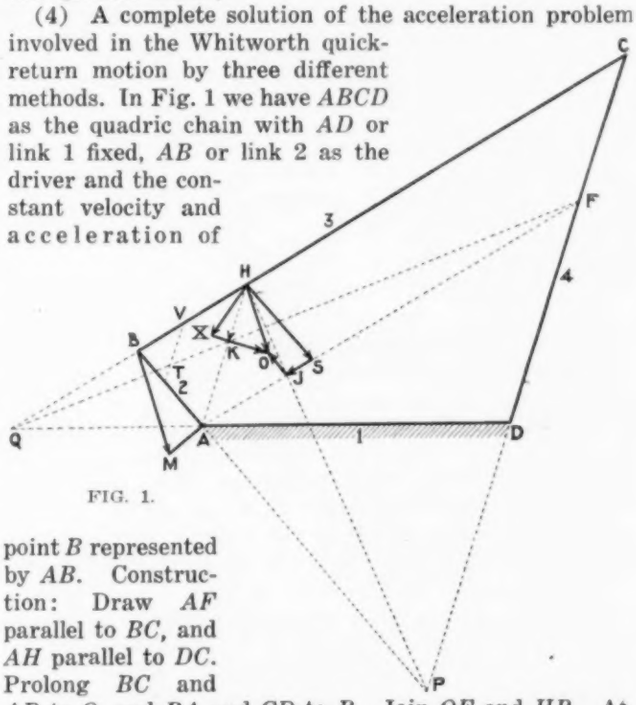


FIG. 1.

Proof: Draw *HS* parallel to *BA*.

Since triangles *JSH* and *BHP* are similar

$$\frac{JS}{SH} = \frac{BH}{BP}. \quad \text{But } SH = AB$$

$$\therefore \frac{JS}{AB} = \frac{BH}{BP} \tag{1}$$

Also triangles *BHA* and *BCP* are similar

$$\therefore \frac{BA}{BP} = \frac{BH}{BC} \tag{2}$$

Multiplying equations 1 and 2 together, cancelling and reducing

$$SJ = \frac{BH^2}{BC} \tag{3}$$

From similar triangles QHK and QCF we have

$$\frac{HK}{CF} = \frac{AH}{CD}. \quad \text{But } CF = AH$$

$$\therefore HK = \frac{AH^2}{CD} \tag{4}$$

Analyzing the figure $HSJOKH$, which is a polygon of accelerations, with H as pole we notice that

$HS = BA =$ acceleration of point B;

$SJ = \frac{\overline{BH}^2}{BC} =$ centripetal acceleration of C about B;

$OJ =$ tangential acceleration of C about B;

$HK = \frac{\overline{AH}^2}{CD} =$ centripetal acceleration of C about D;

$KO =$ tangential acceleration of C about D;

and hence, vectorially, $HK + KO = HS + SJ + JO = HO$, is the resultant acceleration of point C.

It is to be noted that triangle BAH is a triangle of velocities where AB is the velocity of B, AH the velocity of C and BH the relative velocity of C about B. (See Smith's "Graphics" or Dunkerly's "Mechanism.")

Modification of Constant Angular Velocity Construction to Apply to Rittenhaus' Construction

Referring to Fig. 1, we are given the acceleration BM of the point B of the quadric chain $ABCD$ and are required to find the acceleration of point C.

Construction: Lay off BM to scale so that its centripetal acceleration component is represented by the driver-crank radius BA. Then AM represents the tangential component of BM (AM is perpendicular to AB at A). Then, using BA as the total acceleration of B just as if the point B rotated uniformly, and using Rittenhaus' Construction as under case 1 we obtain the acceleration HO. Lay off $BT = AM$ and draw TV parallel to AH or CD. Make $OX = TV$ and join H and X. Then HX is the acceleration of C when the acceleration of B is BM. It should be noted that OX should be laid along the line OK from O to K when AM is left-handed and vice versa in the case of right-handed tangential acceleration. It will be observed that this method consists of finding the independent effects of the components of B and then adding them together geometrically. Or it may be said that we have combined two systems, one a quadric chain with constant angular velocity of the driver, the other a quadric chain momentarily at rest and with the point B having an acceleration AM. The effect of the first system is to give C an acceleration HO. Since the second system is at rest the centripetal acceleration of C about B is zero, the centripetal acceleration of C about D is also zero, and hence the acceleration of C being perpendicular to CD we can find its magnitude by a triangle similar to a triangle of velocities such as BTV. As constructed, the side BT is equal to AM and therefore TV is the acceleration of C due to the second system. Now $HX = HO + OX$ vectorially and as $OX = TV$ in magnitude, we have the total effect HX. It will also be noted that the direction of OX as laid out is along the line OK which is perpendicular to AH or CD. I have used Rittenhaus' Construction in this article as it lends itself conveniently to the modification, but it will be plainly seen that any other construction for finding the acceleration with constant velocity of the driver may be extended to the general case by the use of this principle of the superposition of two independent acceleration systems in plane motion. This theorem does not seem to be given in any of the modern textbooks on Kinematics.

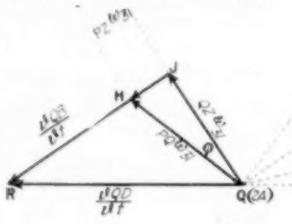


FIG. 2.

General Case of the Quadric Chain

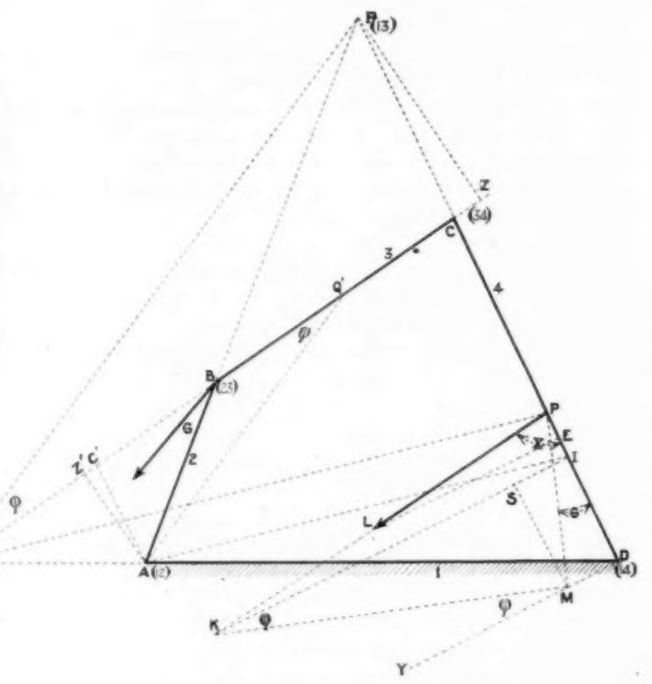
Referring to Fig. 2, we have $ABCD$ as the quadric chain with AD or link 1 fixed. Let ω and A stand for angular velocity and angular acceleration respectively, and the subscripts denote the link and reference link. Thus ω_{41} and A_{41} denote the angular velocity and acceleration of link 4 with respect to link 1. Prolong AB and CD to $P(13)$ and BC and AD to $Q(24)$. Join PQ.

Now we have (Klein's "Kinematics of Machinery")

$$\frac{\omega_{41}}{\omega_{21}} = \frac{24 - 21}{24 - 41} = \frac{QA}{QD}$$

Differentiating with respect to time and using $A = \frac{\delta\omega}{\delta t}$, we have

$$\frac{\omega_{21} A_{41} - \omega_{41} A_{21}}{\omega_{21}^2} = \frac{QD \frac{\delta QA}{\delta t} - QA \frac{\delta QD}{\delta t}}{\overline{QD}^2}$$



But $QD = QA + AD$ and $\frac{\delta QD}{\delta t} = \frac{\delta QA}{\delta t}$ since AD is constant. Hence the above equation reduces after clearing of fractions to

$$\omega_{21} A_{41} - \omega_{41} A_{21} = \frac{AD\omega_{21}^2}{\overline{QD}^2} \cdot \frac{\delta QD}{\delta t} \text{ or solving for } A_{41} \text{ we have}$$

$$A_{41} = \frac{AD\omega_{21}^2}{QD^2} \cdot \frac{\delta QD}{\delta t} + \frac{\omega_{41}}{\omega_{21}} \cdot A_{21}$$

But $\frac{\omega_{24}}{\omega_{21}} = \frac{\omega_{42}}{\omega_{12}} = \frac{14 - 12}{14 - 42} = \frac{DA}{DQ}$, or $\omega_{24} = \frac{DA}{DQ}\omega_{21}$,

hence substituting above we have

$$A_{41} = \frac{\omega_{24}}{QD} \cdot \frac{\delta QD}{\delta t} + \frac{\omega_{41}}{\omega_{21}} \cdot A_{21} \tag{1}$$

In order to find $\frac{\delta QD}{\delta t}$ we proceed as follows: The point Q as a point on link 3 has a velocity QH perpendicular to QP about P. But if Q is to remain on the line QD the point Q must have a velocity along link 3. Hence, draw QH perpendicular to QP and equal to $QP\omega_{21}$ and draw HR parallel to link 3 and we get QR as the value of $\frac{\delta QD}{\delta t}$.

Draw PZ and AZ' perpendicular to link 3, draw AC' parallel to link 4, draw AQ' parallel to PQ and QJ perpendicular and HJ parallel to link 3.

Now triangles QHJ, QPZ and $Q'AZ'$ are similar and we have

$$\frac{JH}{PZ} = \frac{HQ}{PQ} = \frac{PQ\omega_{21}}{PQ} = \omega_{21} \text{ or } JH = PZ\omega_{21}$$

similarly $QJ = QZ\omega_{21}$

Also $$\frac{JH}{AZ'} = \frac{QH}{AQ'} = \frac{PQ\omega_{21}}{AQ'} = \frac{PB\omega_{21}}{AB} = \omega_{21}$$

Hence $JH = PZ\omega_{21} = AZ'\omega_{21}$ and similarly $QJ = QZ\omega_{21} = Q'Z'\omega_{21}$

All of these relations could have been derived immediately by use of Professor Roseburg's Phorograph or by a simple application of the elementary notions of the physical properties of a rigid body in plane motion. It will be noticed that the images Z', C' and Q' of the points Z, C and Q have been marked to correspond. (See Angus' "Theory of Machines.")

Again—triangles QJR and $AZ'Q$ are similar and we have

$\frac{QR}{QJ} = \frac{QA}{AZ'}$. But $QR = \frac{\delta QD}{\delta t}$ and $QJ = Q'Z'\omega_{21}$ from above, and

$AZ' = Q'Z' \tan \phi$ where ϕ is the angle BQP or angle $BQ'A$. Substituting we have

$$\frac{\frac{\delta QD}{\delta t}}{Q'Z'\omega_{21}} = \frac{QA}{Q'Z' \tan \phi} \text{ or } \frac{\delta QD}{\delta t} = QA\omega_{21} \cot \phi.$$

But $QA_{21} = QD_{41}$ and hence $\frac{\delta QD}{\delta t} = QD\omega_{41} \cot \phi$. Substituting this in equation 1 we get

$$A_{41} = \omega_{24}\omega_{41} \cot \phi + \frac{\omega_{41}}{\omega_{21}} A_{21} \qquad (2)$$

Dividing by ω_{41}^2 we get

$$\left(\frac{A_{41}}{\omega_{41}^2}\right) = \left(\frac{\omega_{24}}{\omega_{41}}\right) \cot \phi + \left(\frac{\omega_{21}}{\omega_{41}}\right)\left(\frac{A_{21}}{\omega_{21}^2}\right) \qquad (3)$$

Now equation 3 gives us a relation between the tangents of the angles made by the acceleration vectors of any points on links 1 and 4 with their corresponding radii, and lends itself to a very simple graphical construction.

Let G and X be the angles made by the acceleration vectors with links 1 and 4 respectively (see Fig. 2). Then we have $\frac{\omega_{24}}{\omega_{41}} = \frac{AD}{QA}$ and $\frac{\omega_{21}}{\omega_{41}} = \frac{QD}{QA}$. Substituting we have

$$\tan X = \frac{AD \cot \phi + QD \tan G}{QA} \qquad (4)$$

Now let P be any point on link 4 and we are required to find its acceleration, having given the acceleration of any point on link 1. Divide the radial distance PD in the ratio QA is to QD at I by joining Q to P and drawing AI parallel to QP. At D and I erect perpendiculars DM and IK to PD. Draw PM making angle MPD equal to angle G made by the vector of any point on link 1 with its radius vector to center A, and draw KM making the angle KMY equal to ϕ. Join the intersection K of KI and KM to P, and we have $KPD = X$ = angle made by acceleration vector of any point on link 4 with its radius to center D. If we now lay off from P to D the centripetal acceleration $PD\omega_{41}^2$ from P toward D, say PE, which can be easily calculated or constructed graphically, and draw a perpendicular to PD at the point E, limited by the line PK at L, we then have EL as the tangential acceleration and PL as the total acceleration of point P on link 4.

Proof: Draw MS parallel to link 4. Then we have

$$\tan X = \frac{KI}{PI} = \frac{KI}{ID} \cdot \frac{ID}{PI} = \frac{KS + SI}{ID} \cdot \frac{ID}{PI}$$

$$= \frac{KS + MD}{ID} \cdot \frac{ID}{PI} = \frac{KS}{ID} \cdot \frac{ID}{PI} + \frac{MD}{ID} \cdot \frac{ID}{PI}$$

$$= \frac{KS}{SM} \cdot \frac{ID}{PI} + \frac{MD}{PI}.$$

But $\frac{KS}{SM} = \cot \phi$ since angle $SKM = KMY = \phi$

$$\frac{ID}{PI} = \frac{AD}{QA} \text{ by construction}$$

$$\frac{MD}{PI} = \frac{PD \tan G}{PI} = \frac{QD}{QA} \tan G$$

Substituting we get $\tan X = \frac{AD}{QA} \cot \phi + \frac{QD}{QA} \tan G$ which satisfies 4.

In the practical execution of this construction we can use the length PE, instead of PD, if the length of the centripetal acceleration vector permits a conveninent scale, and thereby eliminate the drawing of one line, save time and obtain the resultant acceleration more directly. It should be noted that this construction solves the problem of going directly from link 1 to link 4 without finding the accelerations of points B and C as intermediate steps, and therefore overcomes the difficulty mentioned in the books on Kinematics. (See Klein's "Kinematics of Machinery," page 161, last paragraph; Dunkerly's "Mechanism," page 265, second line, etc.; Durley's "Kinematics of Machines," page 158, top line; Angus' "Theory of Machines," page 281, top and bottom lines; Dalby's "Valve and Valve-Gear Mechanisms," page 289, line 10.)

It also gives a very simple construction for finding the angular acceleration of link 4 when link 3 is a sliding piece, as will be shown under Fig. 3. In all graphical constructions care must be exercised as to the signs of the various quantities involved, and for this construction the same precaution must be taken in laying out the angles G and ϕ. If the angular acceleration of link 1 is left-hand then the angle $MPD = G$ must be laid off on the left-hand side of the radial distance DP. If the angle ϕ, which is the angle between link 3 or BC and the line QP joining centers 24 and 13, is obtained by rotating BC about Q in a left-hand direction, is called plus, then the angle YMK, which is equal to φ, must be laid off right-handed or in a negative direction from the line YM about M.

The Whitworth Quick-Return Motion

Referring to Fig. 3 we have the turning-block slider-crank chain of Reuleux which is applied to quick-return motions. There are two quadric chains, 1234 and 1456. The problem is to determine the acceleration of the block 6 when the angular velocity and angular accelera-

tion of the driving link 2 are given about its fixed center $A(21)$. The procedure in each method will be to find the acceleration of the point $E(45)$ from the quadric chain 1234 and then to find the acceleration of $F(56)$ from the quadric chain 1456. Only one solution of this second step will be shown, as the main difficulty lies in determining the acceleration of point E. The three methods used for the solution of this problem will be based upon (a) law of Coriolis, (b) analytical method, (c) the original construction, section 3.

Solution Using Law of Coriolis

Let BB'_2 represent the velocity of point B about the fixed center $A(12)$. Then if the angular velocity ω_{21} is constant, $BB''_2 = \frac{(BB'_2)^2}{AB}$ = centripetal acceleration of point B on link 3. We will first consider the case of constant angular velocity of the driver. Resolve the velocity BB'_2 into its normal BB' and sliding $B'B'_2$ components. Then the velocity of the point on link 4 directly under B on link 3 is also BB'. Join B' and D. Then the angle BDB' will represent the angular velocity ω_{41}. (By saying that a finite angle represents an angular velocity or acceleration I mean the tangent of the angle. If the angle is infinitesimal, then it makes no difference whether we use the tangent or the angle). Draw EE'_1 perpendicular to DE and limited by the line DB' extended and we have the velocity of point $E(45)$. To find the velocity of $F(56)$ draw EF''_1 parallel to the path of F and $E'_1F'_1$ perpendicular to link 5. Then EF''_1 is the total velocity of $F(56)$ and $E'_1F'_1$ is the relative velocity of point F to point E. This completes the solution of the velocity determinations.

Now considering point B on link 3 as having a relative velocity equal to the sliding component $B'B'_2$ along link 4 and at the same time partaking of the angular velocity and acceleration of link 4, we know by the law of Coriolis that the total acceleration of B (which in this case is given and equal to BB''_2) is the sum of three accelerations (see article by the same author on page 928 of last issue). These accelerations are the acceleration of point B on link 4, the relative acceleration of point B to link 4 which we know in this case has the direction of the line of link 4, and the fictitious acceleration equal to twice the product of the relative velocity $B'B'_2$ and the angular velocity ω_{41}. To determine this third component graphically lay off DN on link 4 equal to twice $B'B'_2$ and erect a perpendicular NN' to DN at N and limited by the line BB'. Then NN' is the fictitious component. The direction of the acceleration will be from N to N' in this particular position for if link 2 is considered to be rotating counterclockwise link 4 is rotating clockwise. Lay off BB''_3 from B toward D to represent the centripetal acceleration of point B on link 4, which is equal to $\frac{(BB')^2}{DB}$, draw $B''_3B''_2$ perpendicular to link 4 at B''_3 and draw the line $B''_3B''_2$ also perpendicular to link 4 and

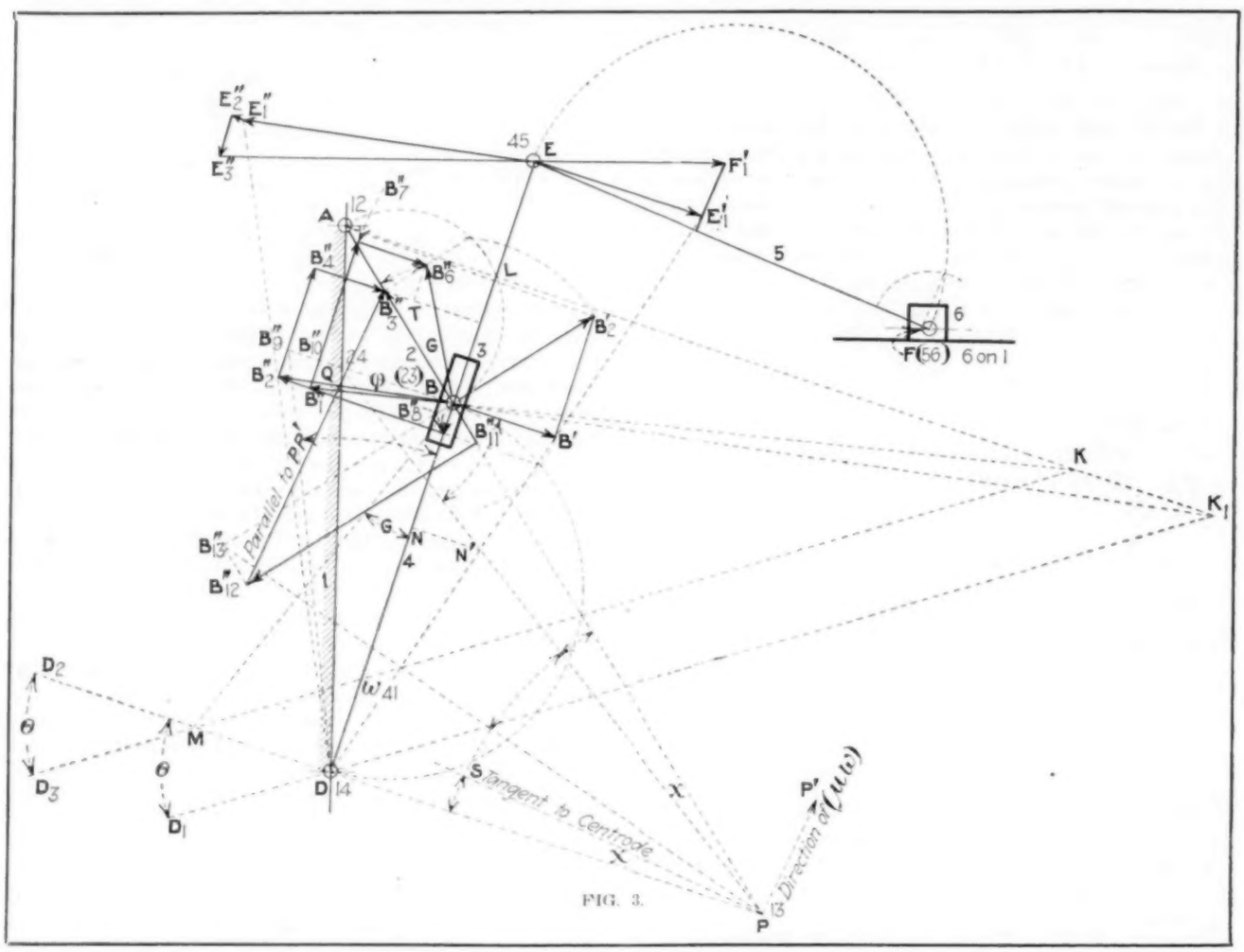


FIG. 3.

equal to NN'. At B''_4 draw $B''_4B''_3$ parallel to link 4 and we have by joining B with B''_3 the acceleration of point B on link 4. The acceleration of point B on link 3 relative to point B on link 4 is $B''_3B''_4$ (that is the block has this acceleration relative to rod 4) and $B''_4B''_3$ is the Coriolis component. These three accelerations add up vectorially to the resultant acceleration BB''_3. Draw $DB''_3E''_1$ and through point E draw EE''_1 parallel to BB''_3 and we have EE''_1 as the acceleration of point E. Draw BB''_6 at B perpendicular to link 4 and we have by joining D with B''_6 the angular acceleration of link 4 represented by the angle B''_6DB.

Draw $E''_1E''_2$ parallel to link 5 and equal to $\frac{(E_1F_1)^2}{EF}$ to represent the centripetal acceleration of F to E and draw $E''_2E''_3$ perpendicular to link 5 to represent the direction of the tangential acceleration of F about E. Since the direction of acceleration of F is known, draw EE''_3 parallel to the path of F and we get EE''_3 as the absolute acceleration of point F.

In case the angular velocity of the driver is variable, and the total acceleration of B is represented by BB''_6 making an angle $G = B''_6BA$ with the driver radius AB, we proceed as before and we obtain $B''_7B''_6 = B''_4B''_3 = NN' =$ fictitious component. $B''_1B''_7$ is the relative acceleration of the block to the link 4 and $B''_4B''_1$ is the tangential acceleration of point B on link 4 and hence BB''_1 represents the total acceleration of point B on link 4 instead of BB''_3 which we found in case of uniform angular velocity of link 2. The angle BDB''_{10} (not drawn) would now represent the angular acceleration of link 4. From this acceleration we can as before find the total acceleration of E and then of F.

It should be noted that the effect of the tangential component $B''_3B''_6$ alone, with the quadric chain at rest, would be to decrease the tangential component $B''_4B''_3$ by $B''_4B''_1 = B''_3T$ and to increase the relative acceleration $B''_3B''_4$ by TB''_6. This relation is self-evident from an inspection of the figure (see item 2).

Prolong AB and draw DP perpendicular to link 4 at D and we obtain center $P(31)$. Draw QB perpendicular to link 4 at B and we obtain point $Q(24)$ on line of centers AB. Join Q and P. Make angle $DPS = QPB$ (marked ψ in figure). Then SP will be tangent to the centrodes at P. Draw PP' perpendicular to SP to represent the direction of acceleration of the instantaneous center P. (See Bobillier's "Construction"; Klein's "Kinematics of Machinery.")

Draw BB''_{11} equal to $\frac{(BB_2)^2}{BP}$ to represent the centripetal acceleration of B about P, draw $B''_{11}B''_{12}$ perpendicular to BP at B''_{11} and draw through B''_3 (the end of the acceleration vector of B) the line $B''_3B''_{12}$ parallel to PP'. Then we have $B''_{11}B''_{12}$ as the tangential acceleration of B about P and $B''_{12}B''_3$ as the acceleration ($\mu\omega$) of the instantaneous center.

Draw $B''_{12}B''_{13}$ parallel and BB''_{13} perpendicular to BP and we have the angular acceleration of link 3 about instantaneous center $P(31)$ represented by the angle $B''_{13}PB$. As stated before, we cannot find the angular acceleration of link 4 from the center $C(34)$ which is at an infinite distance and has an infinite acceleration; but since link 3 and link 4 are connected by a sliding joint they have the same angular velocity and angular acceleration, and hence the angle $B''_{13}PB$ also represents the angular acceleration of link 4. For graphical construction, therefore, we have only to make the angle $B''_6DB = B''_{13}PB$ and thus obtain the tangential acceleration of point B on link 4 about D. The centripetal acceleration BB''_4 is obtained as before and we thus obtain the resultant acceleration of point B on link 4. Then proceed as before to determine the acceleration of E and F.

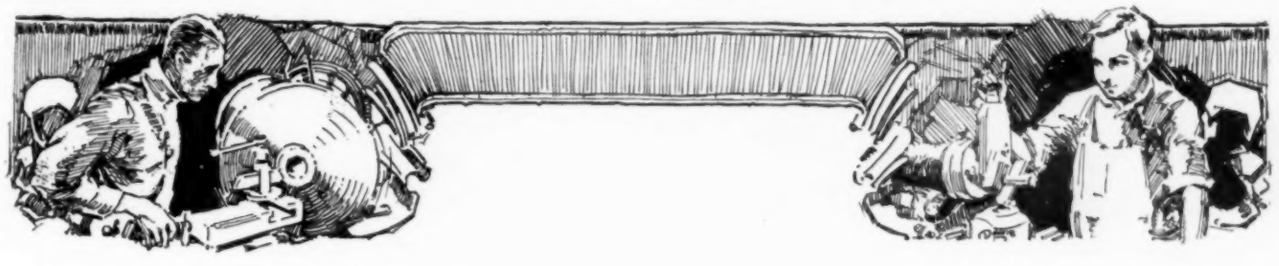
In the case of variable angular velocity the only change will be to draw the line parallel to PP' through B''_6 and determine new points B''_{12} and B''_{13}.

Draw AKK_1 perpendicular to link 4. This intersects link 4 at L. It should be noted that $Q(24)$ lies between A and D, whereas in Fig. 2 Q was external, and hence we divide the distance BD in the negative ratio of QA to QD at L. In the case of constant angular velocity of the driver draw DD_2 perpendicular to link 4 and then draw D_1DK_1 making an angle D_1DD_2 equal to $BQP = \phi$ (see Fig. 2), counterclockwise with D_2D (since QB must be turned clockwise to arrive at QP; see rule under item 3). Join K_1 with B indefinitely and we get the angle B''_2BD as the angle between the acceleration vector for point B on link 4 and radius DB.

In the case of variable angular velocity make angle $DBM = B''_2BB''_4 = G$ and draw D_2MK making the angle $D_2MD_3 = \phi$ counterclockwise with D_2D and we get by drawing KB indefinitely the angle B''_1BD as the angle between the acceleration vector and radius DB of point B on link 4.

The centripetal acceleration BB''_8 can now be obtained and a perpendicular erected at B''_8 and we have BB''_2 and BB'' as the acceleration of point B on link 4 in the cases of constant and variable angular velocity of link 2 respectively. Then proceed as under case (a).

In the quadric chain when the joint (23) becomes a sliding joint, Rittenhaus' Construction fails, because center $B(23)$ is at an infinite distance and has an infinite acceleration. But the reader will find that methods (a) and (c) directly apply, whereas with method (b) a little ingenuity in applying the fact that the angular acceleration of links 2 and 3 are the same will give the tangential acceleration component of center $C(34)$ about the instantaneous center (13). Care must also be exercised in using Bobillier's Construction, as before, in order to take care of the sign of the angle ψ. In method (b) it will be noted that center $B(23)$ is at an infinite distance and the problem is worked out as hinted above, the components of the acceleration about the instantaneous center (13) of the point $C(34)$. With these suggestions the writer believes that there will be no difficulty in solving this particular quadric chain by method (b).



The New Railroad Shops at San Bernardo, Chile*

By CARLOS VALENZUELA CRUCHAGA, C.E.

In a far off Latin-American country there has lately been put in commission a very complete system of shops and equipment for repairing the rolling stock of a trunk line railway. It should be a matter of pride to the machinists in the United States that the complete plans for this system and its equipment were made under the supervision of one of our large machine-tool builders and that this firm was accepted in competition with plans of a number of other engineers.

AS EARLY as 1910 the repair shops of the State Railways of Chile were inadequate to keep up the necessary repairs to the rolling stock of the road. Money for new shops and equipment could not be had until after the passage of the reorganization capital law in 1914, when an appropriation was made for the purpose. Bids were invited for building and equipping a group of shops having capacity for the rapid and economic repairs of 600 locomotives, 483 passenger coaches and 6,000 freight cars, comprising the total rolling stock of the road at that time.

Prizes were offered for the best plans for the shops and equipment and were competed for by a number of responsible concerns. The first prize was awarded to the Niles-Bement-Pond Co., New York, which submitted a very complete set of plans accompanied by specifications and estimates worked out by George Henderson, engineer, in collaboration with experts of the General Electric Co., the Niles-Bement-Pond Co., and the United States Steel Corporation in their respective fields of electrical equipment, machine tools and structural steel buildings. A general plan of the layout is shown in Fig. 1.

The original decision of the State Railways was to carry out the proposal as indicated by the accepted plan. However, on account of the European war and the high price of steel caused thereby, it became necessary to abandon constructing the buildings according to the original plans and to construct them of reinforced concrete according to plans offered by the Compania Holandesa at the time the bids were opened in July, 1915.

Apart from the difficulties of reinforced concrete construction in a locality having but little available labor trained in that class of work, the change in plan was a good one as the material used offers reasonable resistance to earthquake shocks that are prevalent in this country.

Starting the Buildings

The first part of the work done was on the group of buildings to be used as repair shops for locomotives (6 buildings), leaving the passenger and freight-car shops to be built at a later date.

A plot of ground consisting of 120 hectares (about 300 acres) was purchased for about $5,000, United States gold, in the vicinity of San Bernardo, about 10 miles south of Santiago, Chile. Of this ground about 112 acres was for the general shops and about 188 acres for the workmen's houses. Contracts were made with the Holland company for the buildings for approximately $1,250,000, United States gold.

The machinery was all obtained from the Niles-Bement-Pond Co., author of the general plan, for $604,500, and all the equipment was installed under the direct supervision of engineers associated with that organization. On April 15, 1920, the shops were opened for operation.

The location of the shops at San Bernardo was chosen on account of its being the approximate center of traffic of the general State Railways, although not necessarily in the geographical center. Likewise it was possible here to obtain an excellent plot of ground parallel to the central railway and accessible to both extremities of the line where trains could enter and leave with great facility. The relative nearness of

*This is a somewhat condensed translation from an article printed in the October issue of *Ingeniería Internacional*.

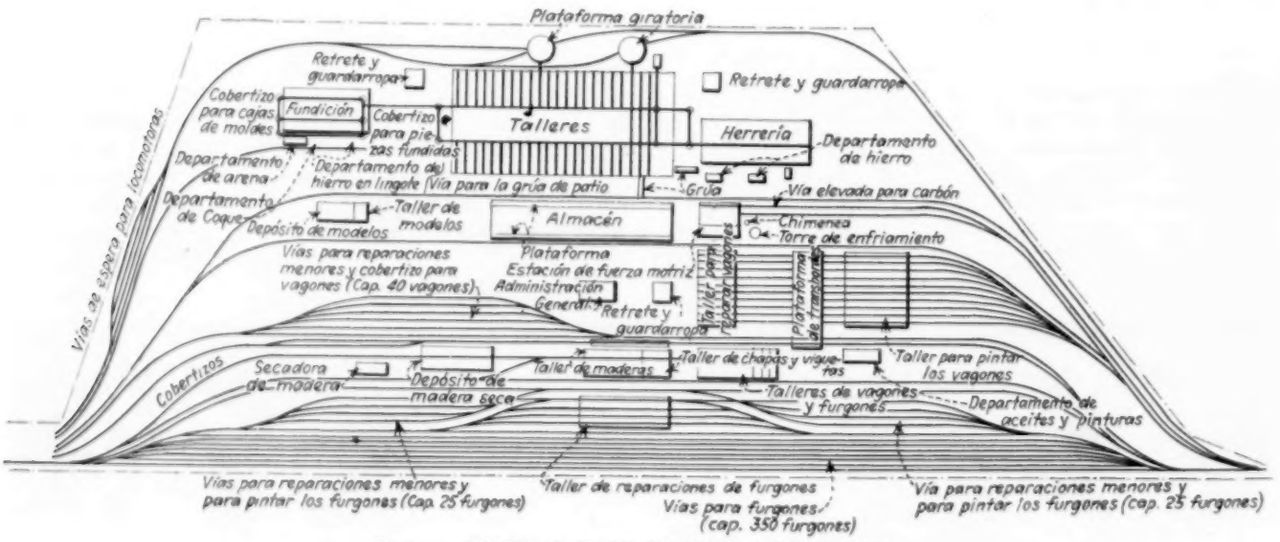


FIG. 1. GENERAL PLAN OF SHOPS AND TRACKS

FIG. 2. GENERAL VIEW OF THE SHOPS

Santiago, which would be the only source of supply in the early part of the work, likewise was a factor in the choice.

The shops as shown in Fig. 2 are grouped along both sides of a long avenue running from east to west and along which a 10-ton bridge crane travels the entire length. This avenue is paved with Belgian blocks, permitting the use of motor trucks for carrying loads of small stuff between the shops.

The locomotive shop touches this avenue on the south and is in the center of the group of buildings, the blacksmith shops and foundry being placed so as to deliver their products to it with ease. The pattern shops and the pattern storeroom are alongside the foundry.

Repairs to freight and passenger cars are made outdoors in yards laid out for the purpose. One of the yards where repairs to woodwork are made is located alongside the lumber yard and the dry kiln and the carpenter shop. In another yard, close to the car and blacksmith shops, repairs to metal parts are made and wheels are replaced. After repairs are completed the cars are painted in whichever yard they may be found. The plans for the car shops (to be built at a future date) call for the installation of tracks and transfer tables so that cars slated for general repairs can be transferred from one department to another.

The shops are all large, well ventilated and lighted and the locomotive shop is of sufficient height to permit traveling cranes to carry material well above any rolling stock that may be on the tracks. The walls are of reinforced concrete 15 centimeters (about 6 in.) thick and waterproofed with "malthoid." The windows have steel sash one-half of which is fixed and the other half arranged to be opened by mechanical means from the floor.

The locomotive shop, a plan of which is shown in Fig. 3 and an interior view in Fig. 4, has five longitudinal bays and at one end there is a transverse bay. The floor dimensions are 187.9 x 87.2 meters (about 176,000 sq. ft.) and is said to be, until recently, the largest area covered by a one-story building of reinforced concrete.

The machine shop occupies the three central bays of the locomotive shop. The center bay of the three contains the light machinery and is equipped with two 5-ton traveling cranes. The two bays next to the center contain the heavy machinery (see Figs. 5 and 6) all of which are served with 15-ton traveling cranes. The two outer bays are used for locomotives undergoing repairs and each is equipped with an 120-ton traveling crane. All the machinery is direct-motor driven. The roof is of the saw-tooth construction, as

FIG. 4. BAYS IN THE LOCOMOTIVE SHOP

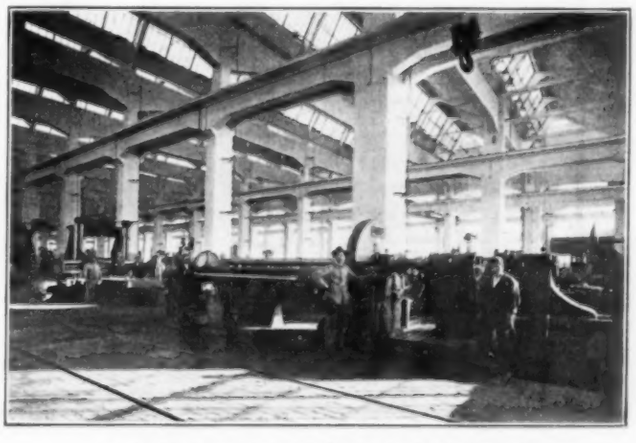


FIG. 5. THE CYLINDER DEPARTMENT

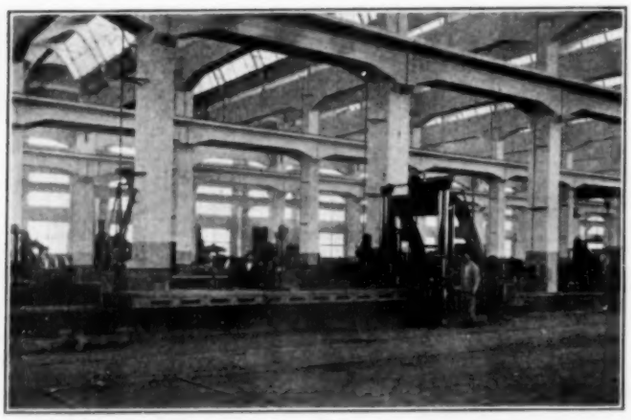


FIG. 6. AMONG THE HEAVY MACHINE TOOLS

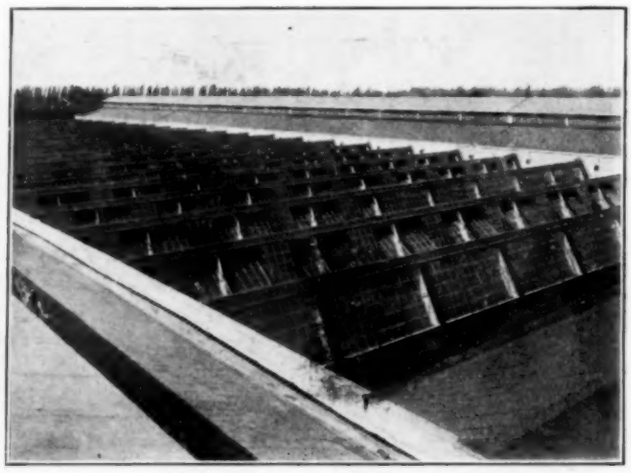


FIG. 7. SAW-TOOTH ROOF OF LOCOMOTIVE SHOP

may be seen in Fig. 7. The glass faces the *south*, as in the latitude of the location the sun is always northerly. The sash is steel and, like the sash in the walls, half of it can be opened for ventilation. For artificial lighting, lamps of 400 watts are conveniently distributed. The transverse bay at the end is used for the repair of boilers and tenders and is equipped with a 15-ton traveling crane. The runways for the two 120-ton cranes also extend through this part of the building.

The machine equipment includes all such machines as would be installed in the most modern railroad shops in the United States. In arranging the machines two methods and their respective advantages were thoroughly considered. The first method embraced the placing of all machines of one type in a group and the second grouping the machines according to the work to be done. While the first method is more economical in the number of machines required to do the work, the second method eliminates long distance trucking and back trucking and for these reasons it was decided to adopt it.

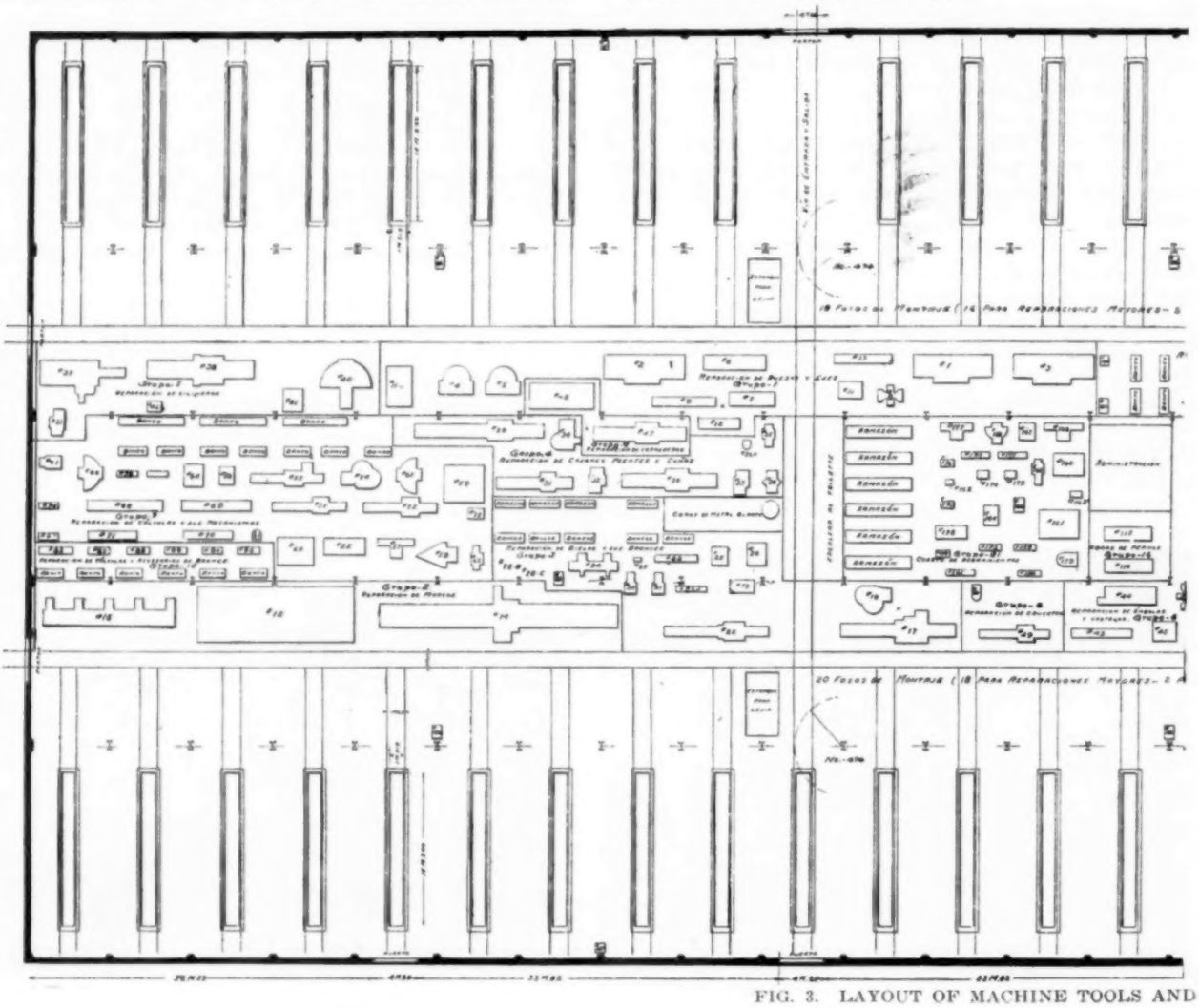
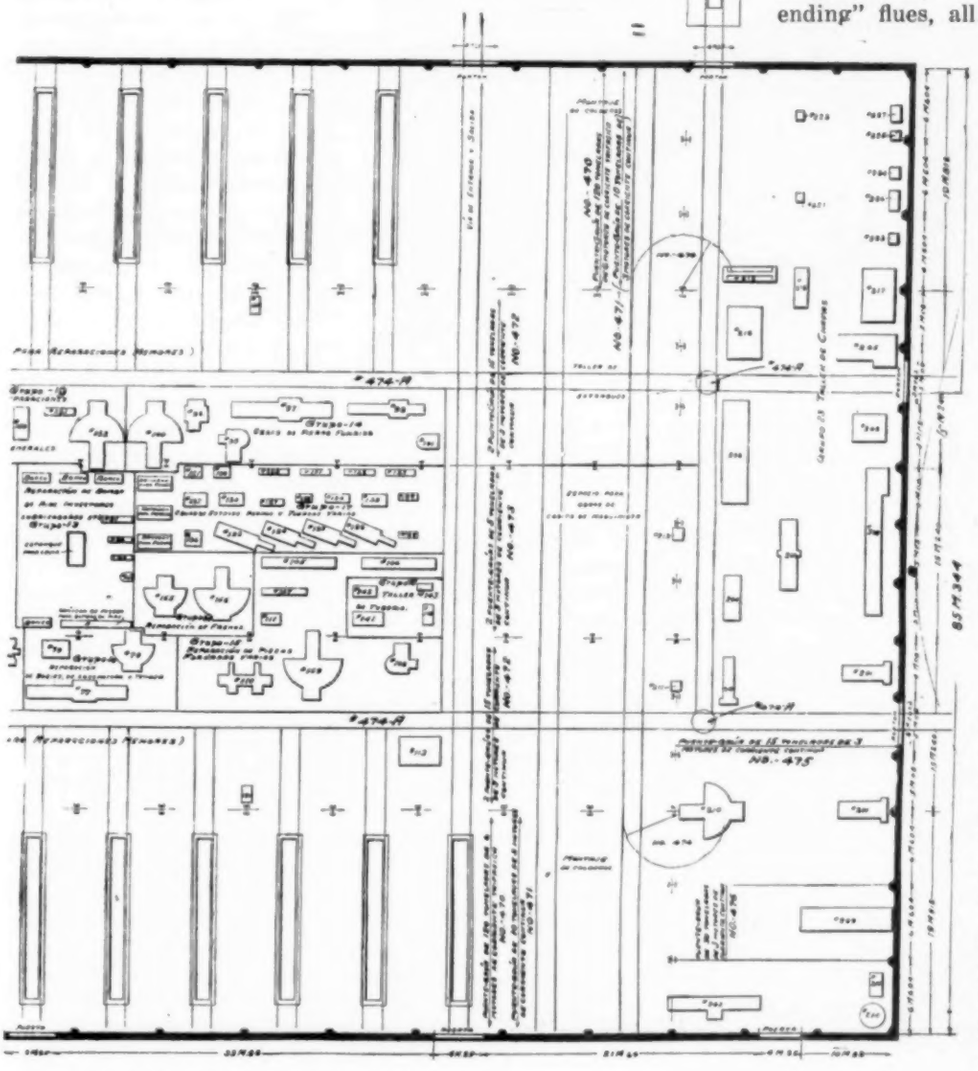


FIG. 3. LAYOUT OF MACHINE TOOLS AND

FIG. 9. IN THE BOILER SHOP

FIG. 10. THE FOUNDRY MOLDING FLOOR

Locomotives enter the shop at right angles to its length after being turned on one of the turntables so distributed that free access may be had to them from any point in the yard. Once within the shop they can be transferred to any of the pit tracks by the traveling crane, as shown in Fig. 8. Here the wheels are removed and sent to the machine shop and the engines lowered on to blocking. After the engines are dismounted, their boilers can be taken to the boiler shop by the same crane that delivered them to the pit tracks. The boiler tubes are taken out and carried outside on special cars to the tumbling barrel for cleaning. They are then brought back on the same cars to have the bad parts cut out and new pieces welded on. The boiler shop equipment comprises punching and shearing machines, bending rolls, machines for welding and "safe ending" flues, all of which are served by a traveling crane. An interior view of this shop is shown in Fig. 9.



PIT TRACKS IN THE LOCOMOTIVE SHOP

The foundry is located to the eastward of the locomotive shop and covers an area of 2,789 sq.m. (about 30,000 sq.ft.). The molding floor, shown in Fig. 10, is served by two 15-ton and two 5-ton traveling cranes and three 1-ton hoists. The runways for the cranes extend beyond the building at both ends, so that the cranes can pick up and deliver material from or to the yards. The yard at one end is used for the storage of castings and that at the other end for flasks. Beyond and near the railroad track, sand, coke, iron, etc., are stored.

The foundry was designed to produce 25 tons of casting per day with 35 tons as a possibility. Two cupolas have been provided, one having a melting capacity of 10 to 12 tons per hour, while the capacity of the other is 3 to 5 tons. The small cupola is used when only a small amount of iron is to be melted, and is also intended to be used for melting iron for a Bessemer converter, which it is expected will be installed

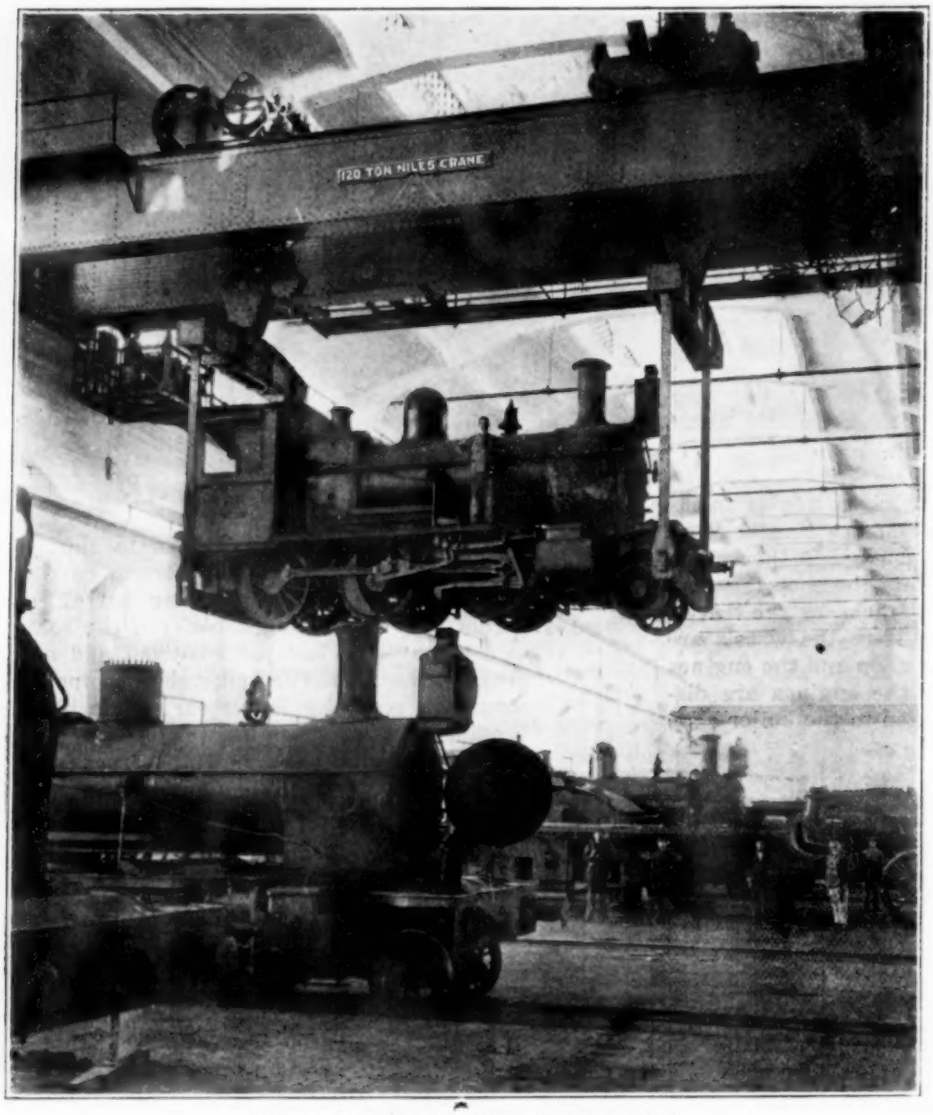


FIG. 8. TRANSFERRING A LOCOMOTIVE

in the future, together with all its accessories. The charging platform is designed for a load of 2,000 kg. (about 4,400 lb.) per square foot, and is equipped with a 2-ton elevator for delivering material for the cupola. Included with the building are the carpenter shops and the cleaning and core rooms.

The pattern shop has a floor space of 667 sq. meters (about 7,200 sq.ft.), and is isolated from other buildings to avoid the danger from fire. The building is divided by a concrete wall into two parts, the small part being used for pattern making and the larger for pattern storage.

The Blacksmith Shop

The blacksmith shop has a floor area of 3,535 sq. meters (about 38,000 sq.ft.), and is located conveniently to the machine shops and the site for the future car shops. It has two bays, one of which contains departments for heavy forgings, spring making and reworking scrap, while in the other stampings and tool forgings are made. All the furnaces are oil fired and air is supplied by blowers or from an air compressor. Several steam hammers and a 2-ton hoist are included in the equipment.

The storeroom is located in a large two-story building, each floor being 79.54 x 24.38 meters (about 21,000 sq.ft.). Platforms are placed on both sides of the building for unloading freight from the cars. The interior is divided into three bays in the center, in one of which there is a 3-ton traveling crane, operated from the floor. The second floor is served by a 2-ton elevator and a stairway.

Power is transmitted from the La Florida (the plant supplying Santiago), the current being a.c. 12,000 volts, and is converted into 220-volt d.c. for operating the machinery by two sets of 500 kw. rotary converters. For lighting a.c. current is used, the voltage being reduced to 220 by step down transformers.

Cost of Electric Power

The contract for supplying power stipulates the price of $0.06 gold per kw.-hr. for the first 150,000 kw. and $0.03 gold for an excess of that quantity, based on a minimum consumption of 85,000 kw.-hr. per month. From April 1 to Sept. 30, inclusive, $0.12 gold per kw.-hr. will be paid for current supplied between the hours of 4 and 9 o'clock p.m.

In addition to the electric equipment there is a 22 x 14 x 16 in. Ingersoll-Rand air compressor driven by a 3-phase synchronous motor, delivering 1,500 cu. ft. of air per minute at a pressure of 85 lb. per square inch. The sub-station is housed in a one story building centrally located so as to shorten the underground transmission lines.

Three toilets and coat rooms, including shower baths, are provided in separate buildings, each 15.54 meters square (about 2,600 sq.ft.) The floors are paved with square tiles. As there is no sewer system the waste from each toilet is taken care of by a septic tank and after being acidulated and filtered is drained into absorbent wells.

Later the director of the State Railways expects to build the shops for the repairs to the freight and passenger cars and four section shops along the main trunk line, as was contemplated in the original plans.

During the progress of the work outlined in this article, Rodolfo Jaramillo was, and still is, superintendent of motive power and shops, all research work and design being in charge of Rafael Edward while the author was resident engineer in charge of the work. The Chilean State Railway is represented in New York by Jorge Beaumont.

Press Tools for Caterpillar Parts

BY FRANK A. STANLEY

Processes in the manufacture of articles made from sheet metal or tubing will bear considerable study. A man well experienced in die work will often be able to design press tools that will do work in one operation where two or more have been previously thought necessary.

THE line drawing, Fig. 1, illustrates a detail of a header tube for the radiator of the Holt Caterpillar, made at Stockton, California.

This header tube is of brass, 1¼ in. outside diameter, and 0.072 in. thick. There are ten holes punched in a line along the tube, these being ½ in. diameter and spaced 1¼ in. apart on centers. At the same time that the holes are punched, a lip or flange is drawn up on the inside of the tube around the hole as shown by the cross section in Fig. 1. In order to produce this internal flange it was formerly necessary to make two operations, consisting first of a drilling operation in a jig where the holes were drilled through the tube wall to ⅜ in. diameter after which the tube was placed in a press and with a gang punch the holes were enlarged to ½ in., the punches drawing down the metal to form the internal lip or flange which is about 1/16 in. deep.

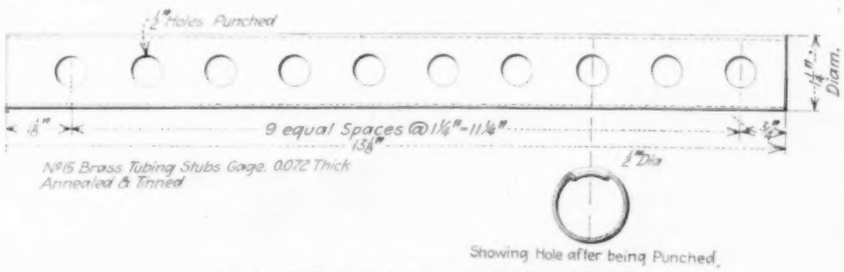

½" Holes Punched
1¼" Diam.
9 equal Spaces @ 1¼"=11⅜"
13⅜"
½" Dia
No 16 Brass Tubing Stubs Gage, 0.072 Thick Annealed & Tinned
Showing Hole after being Punched

FIG. 1. DETAILS OF RADIATOR HEADER

Later an ingeniously designed set of press tools was made to perform the operation at a single stroke of the press without preliminary drilling. These tools are shown by Figs. 2, 3 and 4 herewith.

The die construction combines a work holding mandrel with the die proper and the latter is fitted also with a long wedge which provides for collapsing the die in the work thus enabling the pierced tube to be readily removed after the press ram has completed the up stroke.

In Fig. 2 the die is shown in place in the press and in Fig. 3 the die and wedge are seen withdrawn from the machine and placed at the side of the die shoe. The construction of the press tools will be best understood by examination of the line drawing reproduced in Fig. 4.

The details of the tools may be identified by the following letters: *A* is the cast-iron die shoe; *B*, the cast-iron punch holder; *C*, the die and mandrel, both of tool steel; *D*, the wedge also of tool steel; *E*, the tool steel piercing punches, ten in number; *F* and *G* are two pairs of tool steel locating blocks for holding the die and mandrel in position; *H* and *I* are hexagon-head screws and dowels for securing the locating blocks; *J*, the fillister-head screws for securing the ten piercing punches; *K*, the handles for the die and mandrel; *L*, the guide pins or pillars for the die shoe and punch holder which are the sub-press type; *M*, the guide pin bushings, both pins and bushing being of tool steel; *N*, a locating block for the end of the work to be pierced; *O*, a button-head screw for this block.

Referring to the front elevation and sections it will be seen that the die proper, *C*, is in the form of a round bar which is machined from end to end to form a flat taper face below the center, the slope being 3/16 in. per foot. In this flat lower face there is cut a guide groove and the wedge *D* which is made to a corresponding taper on its upper face has a tongue to fit the groove. This construction will be noticed in the cross sections in the drawings. The two members, the die and wedge, when together form a cylindrical bar which is relieved on the sides to provide a certain amount of clearance to permit easy removal from the work. When the tube to be pierced is slipped over the die, the die constitutes also a carrying mandrel for supporting the inside of the tube during the piercing operation. For placing the work on the die the wedge is removed from the latter and the tube slipped into place on the die. The wedge is then slipped into place fitting snugly into the tube to be pierced and when the

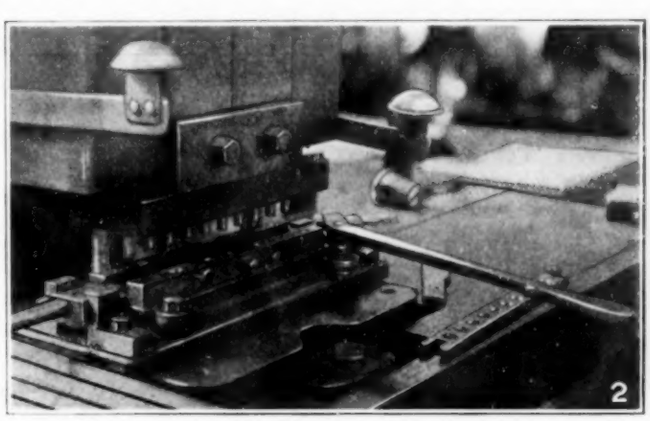


FIG. 2. THE DIE IN PLACE IN THE PRESS

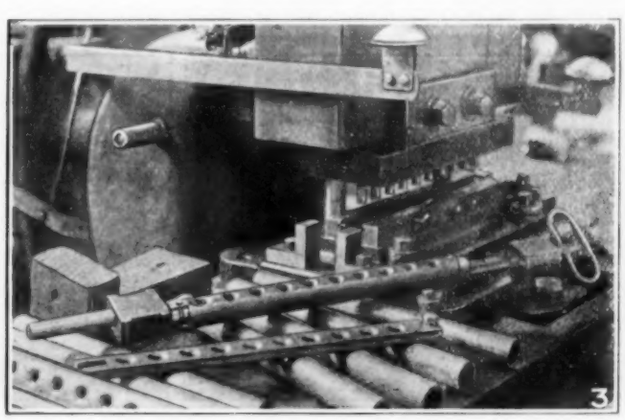


FIG. 3. THE DIE AND WORK REMOVED FROM THE PRESS

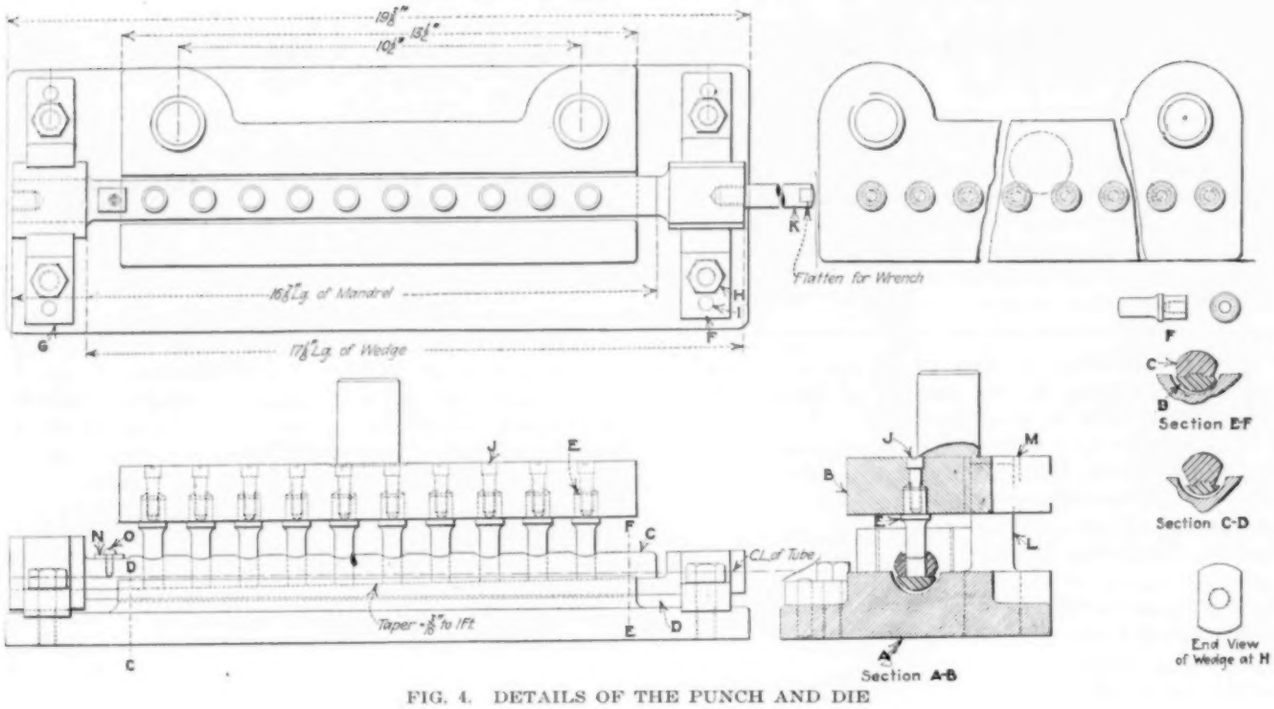


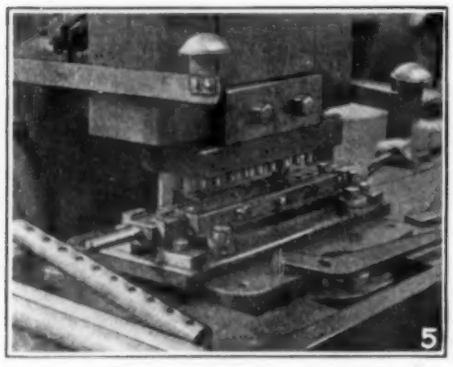
FIG. 4. DETAILS OF THE PUNCH AND DIE

die and its wedge are in the locating blocks *F* and *G* the entire device is securely held for the piercing operation. Withdrawal of the wedge by means of the handle at the right-hand end allows the die to release the work.

Note the shape of the punches, detail No. *E*, Fig. 4. Instead of flat ends with keen corners as with the usual piercing punches, they have rounded ends crowned to a height of $\frac{1}{4}$ in. This is because the punches act as combined drawing and piercing tools. They are in reality what is sometimes known as "pinch off" punches. After the punches strike the brass tube their first work is to draw the metal down into the counterbored chambers at the top of the die opening. Each chamber is the diameter of the piercing hole plus twice the thickness of the brass, in other words $\frac{1}{2}$ in. plus twice 0.072 in., or 0.644 in. in diameter. As the metal is drawn down into these counterbored recesses in the die it forms a shallow shell and continued descent of the punch cuts out the bottom of the metal, leaving a ring or flange around each pierced hole.

There is one detail connected with this set of tools which is not shown on the drawing referred to but which will be seen in Figs. 3 and 5. This is a form of stripper plate which is slipped into the die-shoe jaws above the work. In Fig. 3 the plate with its series of holes to clear the punches will be noticed in the foreground while in Fig. 5 the plate is shown in position over the die in the press. This plate is planed down along each edge to form guide surfaces which enter corresponding grooves in the long jaws attached to the face of the die shoe.

Another interesting set of dies is shown in Fig. 6. These dies are for piercing a long slot in a fiber tube to be used for a conduit. The die itself is in the form of a long arbor or mandrel over which the fiber tube is placed for slotting. The mandrel is slotted out as shown to give the right size of die hole and a clearance slot is cut out below in the bed which carries the die, to enable the punchings to drop out through the press bolster. The punch is an inserted blade in a holder as may be clearly seen to the right. The special feature of the punch is the method of forming a shearing cut from each end toward the center. This shear angle is about 5 or 6 deg. and is sufficient to enable the ends of the punch to strike the fiber surface and enter well into it before the length of the surface has been cut to any appreciable distance. The resulting action is an easy shearing cut which, starting from both ends simultaneously, pierces out the slot with uniform degree of smoothness and without tendency of crowding.



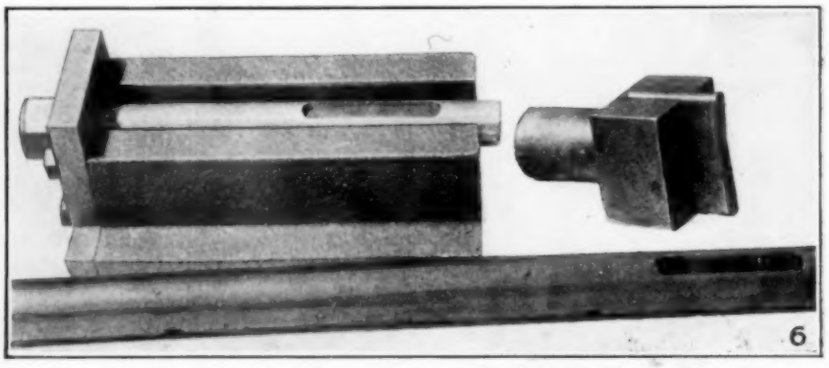


FIG. 5. DIE WITH STRIPPER PLATE IN POSITION. FIG. 6. TOOLS FOR SLOTTING FIBER TUBES

Common Sense in Engineering*

By WALTER M. McFARLAND
Manager, Marine Department, Babcock & Wilcox Co., New York City.

This is a common-sense lecture on Common Sense in Engineering. The author follows what he refers to as the "case system"—developing principles by the examination of specific cases. This system is always a favorite with the party on the receiving end of a lecture, and the reader of this article will be in no way disappointed.

THE term "common sense" is used with great frequency, and yet, as you know, with different meanings. Indeed, it is sometimes said that common sense is really very uncommon. To avoid ambiguity we will attempt a definition as follows: "Common sense" is the application to the solution of problems of one's best experience and judgment without prepossession or prejudice. The qualifying clause is most important, because innumerable cases have occurred where an erroneous decision was reached by men of great ability just because they allowed their judgment and experience to be overruled and biased by prepossession or prejudice.

Possibly the most striking case of this kind, which is known to everybody, is that of the unwillingness of the Syrian general Naaman to take the advice of the prophet Elisha in order that his leprosy might be cured. You remember that the prophet told him to wash in the River Jordan. Naaman's prejudices, however, made him object to this extremely simple cure, and he wanted to know why the rivers of Damascus would not be better. His servant had more common sense than the master, for, as you remember, he said to him that if the prophet had directed him to do some great thing he would have done it at once, and why not follow out this perfectly simple injunction? The common sense of the servant prevailed and the general was cured of his leprosy.

Shrewdness Really Keen Observation

It should also be very thoroughly understood that far from excluding all the benefits of education and intellectual training, the true meaning of "common sense" assumes these as vital factors. In other words, to praise and emphasize the importance of common sense does not mean to disparage education, but, on the contrary, insists upon it most strongly. On account of the native shrewdness sometimes exhibited by uneducated men there is occasionally a tendency to think that common sense is a gift which can compensate for the lack of education. In fact, the shrewdness displayed by these uneducated men when analyzed will be found to agree entirely with our definition above. They are really keen observers, and have, within their limit, good experience, so that the sound judgment which they display is really a good illustration of common sense. It would be found, however, on test that the field within which their judgment could be exercised is very limited as compared with that of the highly-educated engineer.

*From the J. E. Aldred Lectures on Engineering Practice, of the Johns Hopkins University, Department of Engineering.

In discussing the subject of our lecture I propose to follow what is called in the law schools the "case system"; that is, to develop principles by the examination of specific cases. This is usually clearer, more interesting and more satisfactory than to announce abstract principles and then attempt to elucidate them.

Watt and the Steam Engine

A striking illustration of common sense in engineering is the revolution in the use of steam brought about by James Watt, inventor of the separate condenser. The steam engine as invented and developed by Newcomen was doing useful work, but it was very generally realized that it was exceedingly wasteful. As you will remember, the engine worked at atmospheric pressure, steam being admitted from the boiler underneath the piston, which was slightly overbalanced so that it would then ascend to the top of the stroke. A spray of cold water was injected inside the cylinder, which condensed the steam, producing a partial vacuum. The pressure of the atmosphere caused the descending stroke of the piston. It seems to us now that it ought to have been perfectly evident that, as the cylinder was necessarily chilled in causing the condensation of the steam, there would inevitably be great initial condensation of the newly-admitted steam before the temperature could be raised sufficiently to permit the steam to fill the cylinder, and that, in consequence, it was almost obvious that the condensation should take place in a separate vessel. It was, however, not until the Newcomen engine had been used for nearly seventy years that this revolutionary change was made by Watt, who was led to it when making repairs to the model of a Newcomen engine at the University of Glasgow. It must not be supposed because Watt was an instrument maker that he was not a scientific man. He was a friend and pupil of Professor Black of the University, who is, perhaps, best known as the discoverer of latent heat, and it is probable that this scientific knowledge led him to the careful study of conditions which resulted in the invention of the separate condenser.

Watt's Prejudice

As you know, Watt made other great inventions connected with the steam engine, so that, speaking generally, up to the time of the invention of the steam turbine the improvements made by later inventors were almost entirely in matters of detail rather than of principle. It is very interesting to note in this connection that, in spite of his shrewd common sense in his earlier inventions, Watt's prejudices led him to oppose very strongly the use of high pressure. Doubtless it was because the success of his early work was in connection with very low pressures that he was so prejudiced, but it illustrates the point that, notwithstanding his wonderful ability, he did not use common sense with respect to the higher pressures.

As we now look back over the further improvements in the steam engine, we are greatly surprised to find that it took so long to apply fully the principle which Watt had announced of endeavoring to keep the cylinder as hot as the entering steam. Of course, it is impos-

sible to do this completely when the cylinder head and passages have just been in communication with the exhaust at a much lower temperature than the incoming steam. Nevertheless, it should have occurred to a careful analyst of the conditions that division of the expansion into two or more stages in separate cylinders would make the temperature variation in each particular cylinder very much less and would thereby conduce to economy. Long after the compound engine, with the expansion in two stages, had become quite common this point was not fully appreciated. Indeed, as late as 1880 Rankine's Treatise on the Steam Engine, then considered the best work on the subject, distinctly stated that, so far as economy in the use of steam is concerned, it made no difference whether the expansion occurred in one, two or a dozen cylinders. After the principle was thoroughly appreciated and when improved materials permitted the construction of boilers for much higher pressures, the introduction of the triple expansion and quadruple expansion engines came almost as a matter of course.

Westinghouse and the Air Brake

For a number of years I had the pleasure of frequent association with that great mechanical genius George Westinghouse, the inventor of the air brake, while I was an officer of one of his companies, and on one occasion I heard him tell the story of the final step in his invention of the air brake, which is a splendid illustration of common sense. He was led to invent a power brake of some kind by his knowledge of the inadequacy of the means then employed, and his first idea was of one operated by steam. He fully realized the disadvantages due to condensation, but thought at first that these must be accepted. He had devised the brake cylinder and rigging under the car and was nearly ready to experiment. He was a reader of the *Scientific American*, and one day the new issue contained a description of the mechanical features of driving the Mont Cenis tunnel under the Alps. This described the rock drills driven by compressed air, and incidentally stated that, at the time the article was written, the heading of the tunnel where the drills were working was about a mile from the air-compressors outside the mouth, and that there had been no trouble on account of this distance between the generation and application of the compressed air. He at once realized that here was the ideal medium for transmitting his power. If it was satisfactory for the rapid-working pistons of rock drills at a distance of a mile from the compressor it certainly would be satisfactory in the brake cylinders under the cars at a distance measured by hundreds of feet. Thus was born the air brake, which, with its subsequent developments and improvements, has probably done more for the safety of high-speed railroading than any other single invention ever made.

The first great improvement was again a beautiful illustration of common sense. In the beginning the idea was to apply the brakes on all the cars practically at the same moment so as to stop all the cars at the same time. After this had been successfully accomplished and people began to rely thoroughly on the brake, an accident occurred when some cars broke from a train on an incline, which left nothing but the hand brakes to stop the descent of the detached cars. Up to that time, when it was desired to apply the brakes, pressure was admitted to the train pipe, and so to all the brake cylinders. Common sense suggested to Mr. Westinghouse that if it could be aranged to keep pressure on the train pipe as the normal condition, with the release of this pressure to set the brakes, then if any cars became detached the brakes on the cars would be automatically set. To carry out this idea he invented what is known as the "triple valve," which, in connection with a reservoir of compressed air under each car, fully accomplished this purpose of complete safety. The triple valve fulfills the three purposes of filling the reservoir under the cars, admitting the air from the reservoir under each car to the corresponding brake cylinder for the application of the brake, and exhausting the air from the brake cylinder when the brakes are to be released.

Nearly all of Mr. Westinghouse's many inventions were illustrations of his splendid common sense, and they evolved from existing methods to meet conditions which arose in the application of the mechanism. One of these inventions was made while I was with him, and I knew many of the details, so that the story will, I believe, interest you.

When Sir Charles Parsons had invented and developed the steam turbine, until it became reasonably economical, Mr. Westinghouse secured the patent rights for the United States and proceeded to develop it chiefly in connection with electric applications. As the power and size of the turbines increased it was found that there were difficulties due to the expansion of the material accompanying temperature changes in such long structures. As you are aware, the Parsons turbine is of the "reaction type." De Laval, a Swedish inventor, had developed a different kind of turbine, known as the "impulse type." In this latter the steam is expanded in special nozzles before entering the blades so as to reach them with a very high velocity and greatly reduced pressure. Familiar as you are with the properties of steam, you know that this reduction in pressure is accompanied also by a reduction in temperature. Mr. Westinghouse was familiar with both types of turbines, and it struck him that the way to obviate the difficulty due to this expansion of the material was a form of compounding the turbines somewhat analogous to what has been done in the steam engine. Consequently he bolted to the casing of the reaction turbine a small independent but connected casing containing a few rows of impulse blades and reduced the pressure from the initial figure of about 200 lb. to about 75 lb. when it entered the reaction blading. This smaller casing was free to expand without affecting the larger one. Along with this he introduced what he called the "double flow" principle by practically putting two reaction turbines in the same casing with the higher pressures in the center and the exhaust connection at the ends. This solved the difficulty, and this method in various forms is the one now used in all the large turbines of today.

The Diesel Engine

The Diesel engine is a most interesting subject for consideration by engineers on account of its remarkable thermal efficiency of some 30 per cent, which is about double that of good reciprocating steam engines. In fact, marine records of good average practice are ½ lb. of oil per brake-horsepower for the Diesel engine and about 1 lb. of oil per indicated-horsepower for a good reciprocating-engine plant.

More than twenty years ago Dr. Diesel believed he had perfected his engine, and many engineers who had studied his work went so far as to say that the steam engine would be obsolete in a few years and would only be found in museums. For a considerable interval thereafter little more was heard of it until about ten years ago. Possibly it was because the basic patent expired at that time and possibly because the engine had been worked out commercially; but at all events the technical papers were full of accounts of Diesel engines being fitted to numerous vessels, and again there was the same prediction that the steam engine would soon be displaced. As a matter of fact, the extent of the use of the Diesel engine has been a great disappointment to its advocates, and at the present time relatively few are being installed in new vessels.

As information was published of the details of these engines, it became apparent that they were all designed with a horsepower per cylinder which did not exceed 250 to 300. At first there were a great many vague statements that experiments were in progress with cylinders to give from 1,000 to 4,000 hp. per cylinder. In one such experiment there was an explosion with serious consequences. At all events, for some time there has been no talk of these more powerful cylinders. It will be realized at once that if any prime mover is to be used for large powers it must be capable of construction in large units. The reciprocating engines of the S. S. "Olympic" have cylinders of 4,000 hp. each, so that a single four-cylinder engine develops 16,000 hp. A Diesel engine developing only 250 hp. per cylinder would, of course, require sixty-four cylinders to give the same power. The enormous multiplicity of parts to be looked after and kept in adjustment, even if this were individually easy, would be sufficient to prevent such use, while, in fact, the Diesel engine requires unusual care and attention to keep it in good order.

The question naturally arises, "Why is it that the Diesel engine cannot be built in large sizes?" And here common sense gives us the answer quite simply. Like all other internal-combustion engines, the Diesel engine requires that the cylinders be water-jacketed so as to keep the barrel sufficiently cool to permit the proper working of the pistons. The pressures carried are quite high, from 700 to 1,000 lb. per square inch, requiring a thick cylinder even for a power of 250 to 300 hp. The fact is that this thickness is evidently about the maximum which will permit the interior cylinder wall to be kept of a sufficiently low temperature for satisfactory working. It happens that cast iron is by far the best material which has ever been found for the cylinders of quick-moving reciprocating engines. If a material could be found which has all the fine wearing qualities of cast iron with several times its thermal conductivity, then we might expect Diesel engine cylinders of greater power; but until that comes, or there is some other radical invention, the nature of which is not now apparent, the Diesel engine seems limited to small powers.

The Commercial Side of Engineering

There is another aspect of this case where that form of engineering common sense which we may call the "commercial side of engineering" comes in very prominently. Popular descriptions of Diesel engines have always laid stress on their elimination of the boilers, with a consequent saving in space. They have, so far as I know, carefully avoided a comparison of weights. Through the kindness of a friend who is chief engineer of a large shipbuilding company, and who had made a very careful comparative study of Diesel engines and steam turbines for certain vessels, I have been enabled to secure reliable data on this point of weight. You will perhaps be surprised to learn that for about 3,000 shaft-horsepower the Diesel engine installation weighs nearly double the steam plant, including turbines, boilers and auxiliaries. As might be expected, there is also a very great difference in the first cost, the Diesel engine exceeding the steam plant by over 50 per cent. My friend made up a very careful comparison of the operation of the two vessels, identical except machinery, extending over a year, with the net result that the earnings based on first cost worked out to almost the same.

This discussion emphasizes the importance of remembering that thermal economy in an engine is only one of the factors to be considered in determining whether it is the best to use. Indeed the matter may be put in this way: Every commercial engineering product must show a profit on the investment. This is just as important as high efficiency, adequate strength or admirable design. Failure to show a profit will offset the greatest merit in these other features.

Common Sense in Naval Engineering

A striking illustration of common sense in engineering came under my personal observation when I was in the naval service, and is worth careful study.

The early vessels of what was then called our "new navy," designed from, say, 1885 to 1890, were fitted with independent air pumps for the main engines. There were usually two air pumps driven by a small two-cylinder compound engine of the crank and flywheel type, the connecting rods of the pumps attaching to the same crankpins as the connecting rods of the engine. While an excellent design from the standpoint of a steam engine for ordinary purposes, there was a serious defect in these engines which was not realized until after they were put in use, due to assuming that an engine which would be satisfactory for ordinary purposes would be equally satisfactory for operating an air pump. In practice they proved very unsatisfactory. If they were given sufficient steam to handle a heavy load then they would run way with a light one. If they were adjusted for the light load, then they would stop when a heavier load came on them. In practice this required a man to give them almost constant attention, which was very undesirable.

As soon as this trouble was recognized, the designers at the Navy Department and in the various shipyards began to scheme methods of remedying the difficulty, and various methods were tried without success. Meanwhile the makers of standard pumps had developed a direct-acting, twin-cylinder air pump somewhat on the lines of their direct-driven water pumps, and this type of air pump has proved a great success. It could be run at any desired speed, depending on the output of the main engine, and required practically no attention. After this pump became available it was used exclusively, but the older ships remained with the unsatisfactory air pumps, and it was highly desirable, if possible, to correct the defect without replacing the air-pump engines. Finally Chief Engineer Bailey (now Admiral Bailey), then Chief Designer in the Bureau of Steam Engineering, took up the problem. I knew him intimately, and he gave me the details of his solution of the difficulty.

Recognizing that the direct-driven air pump was satisfactory, his first step was to find the points of difference between this type and the air-pump engines previously used. The compound engine had been designed with steam ports of the usual proportion, namely, 10 per cent of the piston area. In the direct-driven type the ports were only about 3 per cent of the piston area. In the direct-driven type the port opened wide at the very beginning of the stroke and stayed wide open until almost the very end. The valve gear of the compound engine was arranged, as is usual in such engines, to cut off at about three-quarters stroke; and, being driven by an eccentric, opened gradually and closed gradually, being wide open for only a short time. Mr. Bailey's conclusion was that the direct-driven pump builders had wisely decided to make the port so small that, if the load on the pump became very light and there was any tendency to run away, the steam would be wire-drawn by the small port, enough to prevent any excessive speed. On the other hand, if a very heavy load came on the pump, the port being wide open would permit the steam pressure to come in to its full extent so that the piston could not stop. With the existing conditions of the older plant he must continue to drive the valve by an eccentric, but he knew a valve seat could be fitted with ports about 4 per cent of the piston area, and a new eccentric and valve could be fitted to work without lap or lead so that the port would open at the beginning of the stroke and would be open to some extent at all times. This change was made, and the result was complete satisfaction, as I can testify by personal observation from having been on a vessel where the change was made during my service. I consider this one of the best illustrations of common sense in engineering that I know.

It was emphasized in the beginning of the lecture that common sense does not mean lack of education or absence of fine professional equipment. Indeed, these are vitally necessary, and the story which I am about to tell you will show that a well-equipped man is able to give an opinion which seems almost uncanny.

Judging Speed From Smoke-Stack Size

An accomplished naval engineer, who was one of my instructors at the Naval Academy, once told us of an amusing experience with reference to estimating the speed of a ship. He was attached to a vessel on the Asiatic Station, and during his service a new passenger vessel came out from England which was reputed to be very fast for those days. The two vesels happened to be in port together, and when passing the liner in one of the ship's boats one of a party of officers remarked that this vessel could make sixteen knots. My friend looked at the vessel a little while, and said: "That is impossible, and her speed is probably not over fourteen knots." He was at once asked how he could be so sure, and he replied: "I can tell by the size of the smoke-pipe." This led to jeers from some of the party, who really thought the answer was a joke. Those of you who have studied boiler design at all will probably know at once that there was a real foundation for his statement, and for the benefit of the rest I will give this analysis of the way in which he formed an opinion:

In a well-designed boiler installation there is a definite relation between the cross-sectional area of the smoke-pipe and the grate surface. It was before the days of forced draft, so that he knew the amount of coal that could be burned per square foot of grate surface, and, with the average economy of the machinery, the horse-power which would result. He was a man who had made a careful study of the propulsion of vessels, and knew roughly about what horsepower would be needed to drive a vessel of the size in question at a speed of sixteen knots. He could estimate fairly the diameter of the smokepipe, and with this as a basis a hasty mental calculation showed that the power which the machinery could develop was very much less than would have been necessary for sixteen knots. If any of you have had the opportunity to observe the transatlantic steamers you will appreciate this point about the smoke-pipe by the actual conditions of some of the great liners of today. The S. S. "Mauretania," which is a vessel of about 70,000 horsepower and twenty-five knots speed, has four huge funnels, while the White Star liners of nearly the same displacement have only two moderate-sized funnels, but they make only about sixteen knots. So you see that a man who is well posted professionally in marine matters could really form a fair judgment as to the speed of a vessel by the size of her smokepipe.

An Important Feature

A very important feature in your engineering education and experience is to discover in any specific case the general principle which is involved and which may often be utilized to advantage elsewhere with considerable differences of detail from the original case. A circumstance of this kind came under my observation and illustrates the point quite well.

It was customary in the engines of the navy up to about the beginning of the so-called "new navy" to make the eccentric straps of brass. Somewhat earlier than this, when steel castings had become available, designers for engines of the merchant service had made eccentric straps of steel castings lined with white metal, the idea being, of course, that the white metal furnished the suitable bearing surface, while the steel casting gave adequate strength. The steam launch on one of our vessels had the eccentric straps made of brass, as usual, ½ in. square in cross section, and one of them broke. It was the lower half, which was a half circle with lugs to bolt to the other part. The young engineer who was charged with the repairs did not know of this practice in the merchant service, and having always seen eccentric straps made of brass, tried to make a temporary repair by taking a couple of sheets of ¼ in. sheet brass, bending them to shape, riveting them together with a few copper rivets and bending over the ends to make lugs for attachments to the other part of the strap. Unfortunately, sheet brass is rather brittle, and, as might have been expected, this temporary strap broke off where the lug had been bent. After trying this a couple of times he was about to give up the attempt at repair and have a new strap made at a shop on shore. Another young engineer on board knew of the practice in the merchant service. It was out of the question, of course, to get a steel casting, and it would have been difficult to arrange for using white metal, but he remembered the principle of a proper bearing metal to go against the eccentric, backed up by a stronger one to stand the stress. Accordingly he took a piece of ½-in. square bar iron, had it bent to shape and faced it with one of the strips of ¼ in. sheet brass, securing it to the wrought-iron backing with the copper rivets. This was properly fitted to secure a good bearing, and, of course, worked with entire satisfaction. Later on a new brass strap was secured for use, if necessary, but the repair was so satisfactory that the new strap was never used.

From the circumstances existing in educational establishments it is practically a matter of necessity that in solving problems the data should be furnished you and your work should be chiefly the handling of these data. When you get out into actual practice an exceedingly important part of your work will be the securing of these data accurately, which means that the observations must be made with care and with the aim to be thoroughly correct and reliable. It is not always possible to devise simple checks on the observations which will tell at once whether the records are reasonably accurate, but there are many cases where such checks do exist, and you should endeavor, if possible, to ascertain what such checks are. Some will come from previous observation and experience, some from study, but a great many will be a matter of common sense. A striking case which came under my observation and where common sense was the check is worth telling.

Most of the Mediterranean ports are protected by breakwaters so that the water inside is smooth, and as a result when coal is brought off to vessels it is in rectangular piles on flat scows. Unfortunately, coal dealers in the Mediterranean have a rather bad reputation for trickery. Consequently, in naval vessels when coal is taken on board great care is used in measuring the coal piles so as to be sure of the amount received. I was attached to a vessel which coaled in the harbor of Algiers. A couple of our midshipmen were detailed to measure the coal piles, which were, roughly, 40 ft. long, 20 ft. wide and between 5 and 6 ft. high. At the end of the first day they handed in figures to show the amount received which came to 375 tons. The executive officer of the vessel had been attached to her for some two years, and so was familiar with the rate at which coal could be taken in. He said at once that some serious mistake had been made, for the reason that never before had more than 300 tons been received in one day, even when the conditions were better for rapidity than existed at Algiers.

Common Sense in Checking Up

The midshipmen were told to go over their work again to see if there was any mistake, and they examined their computations but could find no error. I was the possessor of a slide rule, and was, therefore, supposed to be something of an expert on figures, and was called in to see if I could find what was wrong. I had had nothing to do with the coaling, but was on board during the day, and happened on several occasions to notice the young men while they were making their measurements. I checked up some of their arithmetical work and found it was correct, so it seemed that the trouble must be in the measurements themselves. I remembered that when I saw them making the measurements the particular piles on which they were working did not come above their heads, while I noticed a great many heights recorded as being over 6 feet. The solution of the difficulty then occurred to me at once. They had used one of the tape measures from the engine room. If you do not know it now you will learn by experience that the ordinary linen tape measures are fitted with a brass ring in the end for convenience and to prevent the tape from slipping into the case. These rings are invariably torn off after a relatively short service, and the common practice is then to tie a knot in the end of the tape and to make all measurements from the 1 foot mark. I asked the midshipmen if they had used the linen tape, and found they had. It appeared on further investigation that the man who held the knot recorded the figures, which were called off by the man at the other end. The recorder assumed that the other man had deducted one foot before calling out the measurement, while the man at the other end called off what he saw, assuming that the recorder would deduct one foot. There would have been no easy way to check this on the measurements of 20 ft. and 40 ft., but obviously it was absurd to put down heights of 6 ft. 3 in. and 6 ft. 6 in. when, as a matter of fact, they were looking over the piles. Remembering that when I saw them the piles were below the top of their heads, I asked them if there were any piles which they could not look over. On reflection they said that there were none. I asked then where they got their heights of over 6 ft., and at once the error developed that every measurement they had made was one foot too great. When the correction was made the actual amount of coal received was only 275 tons instead of 375.

As you hear the story you may think that these young men were unusually stupid. As a matter of fact, this is not true at all, and both have since made enviable records in the navy. They simply failed to use common sense in applying the obvious check as to height when they could look over the piles of coal, which should at once have called their attention to the carelessness with which they were making the measurements.

Oil vs. Coal

While speaking of this subject of checks on observations you will in time acquire a great many of these from practice and experience, and it is well to do so as soon as possible. For example, with good average coal of, say, 14,500 B.t.u.'s per pound, if all the heat went into the formation of steam (that is, 100 per cent efficiency) you would have an evaporation from and at 212 deg. F. of about 15 pounds. Likewise, with good quality fuel oil of, say, 19,500 B.t.u.'s the corresponding evaporation would be about 20 pounds. These are figures easy to remember, and when you remember in addition that the best average results in good boilers are about 75 per cent efficiency with coal and from 80 to 82 per cent efficiency with oil, you will be in a position to discourage fairy tales about remarkable performances in the way of boiler efficiency. It is the custom now in all carefully-conducted boiler tests to tabulate what is known as a "heat balance," showing the way in which the heat in the fuel is distributed. Two elements of loss which are present in every fuel are the heat carried away in the dry chimney gases and the loss due to moisture formed by the burning of hydrogen. The sum of these two losses at moderate rates of combustion is, roughly, about 15 per cent in the case of coal, and about 14 per cent with oil fuel. You will see at once that if all the other losses are eliminated the possible efficiencies would be only roughly some 85 per cent. Consequently, if figures are shown you indicating an evaporation of 13 or 14 pounds of water per pound of coal, or 18 or 19 pounds of water per pound of oil, you will know at once that these results are impossible. Either there has been excessive priming of the boiler or there has been an error in the observation of the amounts of fuel and water.

Some years ago a friend of mine who is a very able engineer was discussing the matter of what is known as "surface combustion," where the gasified fuel passes through a porous earthen plate and burns on the surface. He asked if I had gone into the matter carefully, and I told him that while I had read something about it

I did not know very much. He then went on to say that it was a matter of the very greatest importance because the efficiency with this method of combustion was claimed to be five or six times as great as by any other method. I reminded him at once that this was absurd because a good average performance with oil fuel gave 80 per cent efficiency, and five times this would have been 400 per cent, which was, of course, ridiculous. He then concluded that the ratio of five or six times referred to the efficiency of an open grate or some other similar very inefficient method of burning coal.

While as engineers we always want our work to be accurate, common sense teaches us that there is a time for everything, and there are often occasions where you want to reach a decision quickly and where approximate data will be just as useful as those which are absolutely accurate. You will find as you go along that there are a number of "thumb rules" or "round figures" which are very convenient to carry in your memory for just such occasions. For example, a square foot of sheet steel 1 in. thick weighs approximately 40 lb., which gives you a "round figure" easy to remember and easy to divide for sizes which you are likely to need. The error is only about 2 per cent. Again, 1 ft. in length of a tube 4 in. in diameter gives one square foot of surface, and 2 ft. long of 2 in. diameter, and 4 ft. long of 1 in. diameter. Here the error is a little greater, being about 4 per cent.

There is another convenient figure to remember at the present time—when the question often comes up as to whether it will pay to change a coal-burning installation to one using oil. If you will take the relative thermal values of oil and coal and allow for the higher efficiency when using oil than coal, which is, roughly, about 10 per cent of the efficiency with coal, you will find that the cost for the same thermal value of fuel may be expressed as follows:

When the price of oil in cents per gallon is half the price of coal in dollars per ton (of 2,240 pounds) the cost for the fuel only is the same. In other words, two-cent oil costs the same as $4 coal. There are economies in using oil due to a smaller boiler-room staff, the absence of ashes and other things, which must be considered, but this "thumb rule" will often enable you to say whether the step is worth considering at all. For example, if oil is selling at five cents a gallon while coal can be obtained for $5 a ton, it is perfectly evident that the difference in the cost of the fuels is so great as to make it unwise to change. If, however, oil, say, is four cents a gallon and coal $7 a ton, the difference is then so small that it is possible the other savings would justify shifting over to oil, so that it is advisable to make a detailed investigation.

From one point of view the talk that I have given you may be regarded as rather disconnected, because so many subjects have been considered, and yet the same theme runs through them all—the application of common sense in the solution of engineering problems. Perhaps the very diversity of the subjects may impress you all the more with the great importance of common sense.

My aim has been to encourage you to develop and trust your own common sense by showing how it applies everywhere and is of the greatest service. Indeed, without it great mental ability is often helpless or goes wrong. One of the most brilliant engineers whom I know, who has designed some of our most important electrical machinery, and who is an accomplished scientist, once said "nine-tenths of good engineering is common sense." And, in closing, let me say again that common sense is not a special gift and does not replace careful study, but it does mean the application to the problem at hand of your best experience and judgment without prepossession or prejudice.

Large Gang Punch and Die

By Harry Johnson

To make the angle iron piece, partly shown in the foreground of Fig. 1 and also in detail in Fig. 2, the dies also shown in Fig. 1 were designed.

As the stock enters the die from right to left, the first stroke of the press cuts out an angular piece, this giving the notch on each end of the piece.

Before the second stroke of the press, the angle iron is pushed ahead under the notching punches. On this stroke the notches are cut, the round holes in the end are punched and the stock is cut apart. On the first end of the bar, a short piece of scrap is produced. After the second stroke, every stroke produces a completed piece.

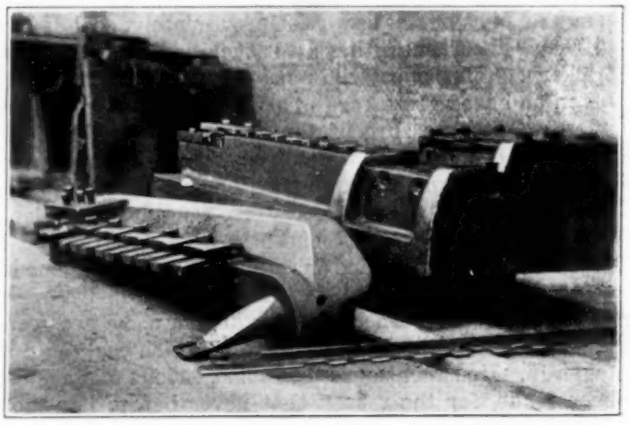


FIG. 1. HEAVY NOTCHING AND PIERCING TOOL

The unique feature of this die is the slide which punches out the angular notches. This slide is inclined slightly from the horizontal, so that it clears the lower limb of the angle and cuts cleanly into the corner where the horizontal and vertical limbs join. The slide is carried forward on the cutting stroke by the long wedge which may be seen projecting from the end of the punch holder. The return stroke is accomplished by means of two heavy coil springs which are recessed inside the base casting.

The notching punches are plain flat strips of steel closely fitted to grooves in the punch holder, and held in place by clamps as shown. The groups at the far end of the punch holder consist of four round punches, with the cut-off punch between.

This punch and die performs at one stroke an amount of work which would call for the following single operations: Cut; notch two ends; cut nine square notches; punch four round holes.

It is used in a Long & Allstatter punching machine. The ends of the vertical notching punches were staggered as to height, so that the punches strike the stock at different times.

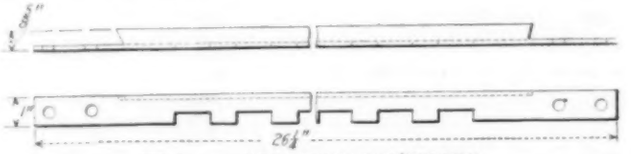
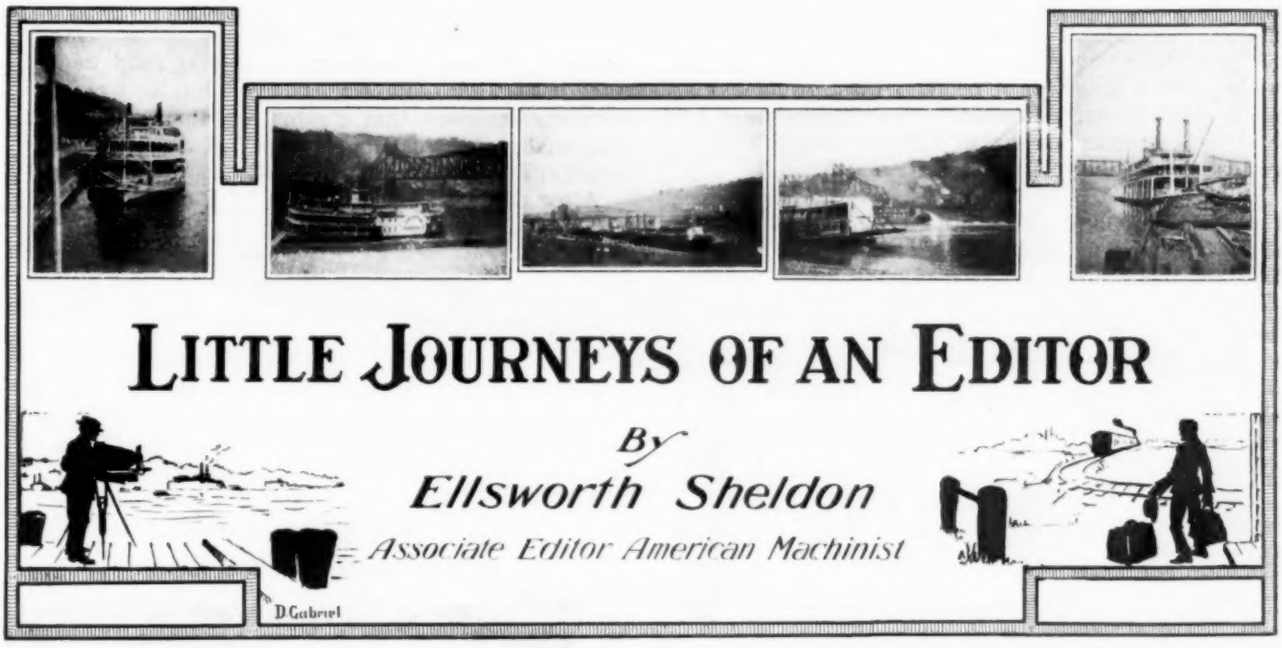


FIG. 2. THE PIECE PRODUCED



LITTLE JOURNEYS OF AN EDITOR

By
Ellsworth Sheldon
Associate Editor American Machinist

AN INTERESTING old machine shop whose windows have for seventy years looked out upon the turbid, iron-stained waters of the Monongahela River just above its junction with the Allegheny, is that founded in Pittsburgh in 1847 by William J. Renton and which, under the guidance of his sons Walter, George and John, is still doing business at the old stand.

In those far-off days, to towns situated as is Pittsburgh, the rivers were the highways of commerce and the business activities of the town were quite apt to be centered along the water front. Here were the important hotels, the larger stores, the open-air markets; and here, too, were the furnaces, the mills, the factories and the machine shops that were the exponents of American industrial life. Railroads, though not unknown, were few and far between, scantily equipped, and had not yet inspired the public with confidence in their future.

An editor on the road has no business hours. His time is subject to the convenience of others, and he is as likely to be doing real work at 3 a. m. as at 3 p. m. Nevertheless he must have his moments of relaxation. There are times when appointments fail, trains do not connect, or he just naturally has to wait for something or somebody. During these off moments he is not always asleep, and he will, under this heading, from time to time endeavor to interest the readers with accounts of things that he sees and hears aside from the main business of his trips.

Mountain roads, almost impassable in Winter and Spring, were about the only link of communication with inland towns, as was the horse or ox practically the only engine of transportation, leaving to the river steamboat, then in the heyday of its glory, the honor as well as the responsibility of keeping cities fortunate enough to be situated on Nature's highway, in touch with each other and with the outside world. It was a day that inspired the proverb to the effect that "large rivers run by large towns."

The Pittsburgh of 1847 was a large town as towns were then considered. It had not yet acquired either of the titles—"The Iron City" or the "Smoky City" by which it later became known throughout the world, and to a Pittsburgher of today it would have seemed but a country village. Yet its importance as a center of maritime commerce was relatively greater and its volume of river-borne traffic larger than it is now.

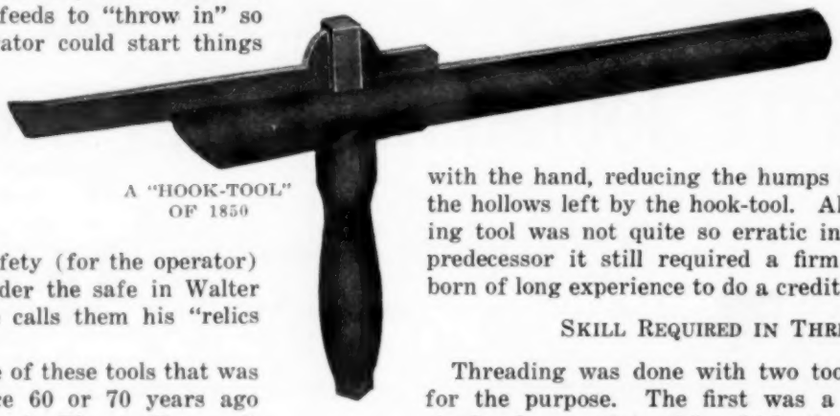
In early manhood the elder Renton, impelled by the genius for mechanics within him, sought service in the engine rooms of the river boats and soon acquired a reputation as an exceptionally skilled and resourceful engineer, and that in a day when an engineer was not only supposed to keep his engines at all times in readiness to move in response to the pilot's bell, but was likewise expected to repair or rebuild an engine in case of accident, or to install a new one should occasion arise. His skill in this direction being much in demand among boats other than the one upon which he was employed, Mr. Renton at length decided to break away from the routine of the river boatman's life and establish himself in the business of building and repairing steam engines. To this end he started a small shop upon the ground where the present shop stands at the corner of Water and Ferry Sts., a short distance from where the Allegheny and Monongahela Rivers unite to form the Ohio.

Machine shops and machine tools of three-quarters of a century ago were not the places and instruments of precision that they are now. Lathes were made largely of wood; planing was generally done with a hammer by the blacksmith before the forging got cold, while a favorite method of finishing flat surfaces of cast iron was by means of a hammer and chisel followed by a "dutch planer" otherwise known as a 14-in. coarse file. Mr. Renton, therefore, before going into the business of making machinery for others was obliged to become a machine-tool builder, with himself as the customer.

Not only was the machinery of the machine shop built partly of wood but so, also, was much of the

machinery turned out by it. The base or bed of an engine, particularly a steamboat engine, was a "timber"; the long unwieldy "pitmans" were (and still are) made from a single spar bound with iron; valve and reach-rods, levers, and other minor parts were jobs for the carpenter and ship builder rather than for him whom we now call machinist.

Running a lathe in those days was not the "cinch" that it afterward became; there were no slide rests and no feeds to "throw in" so that the lucky operator could start things moving and then go to sleep on a soap box. Turning was accomplished with the "hook-tool," two of which still occupy positions of safety (for the operator) if not of honor, under the safe in Walter Renton's office. He calls them his "relics of barbarism."



A "HOOK-TOOL" OF 1850

The picture of one of these tools that was doing valiant service 60 or 70 years ago appears on this page in Fig. 1. To use it the lathesman settled the point of the hook into the rough surface of the T rest, held the long end firmly upon his shoulder with one hand while with the other hand he tilted the downwardly projecting handle in such a way that the lip of the tool was moved forward in a direction parallel with the axis of the work.

If the piece being turned was good homogeneous iron, little difficulty would be experienced. With a properly ground lip the tool would almost feed itself forward until the angle of presentation became too great; when the heel or "hook" would have to be moved forward to get a fresh bite. The long end of the tool must be held tightly down on the shoulder so that the workman could at all times feel the pressure, and woe betide the unlucky wight who let his attention waver. George Renton told me a story in which a machinist whom he called "Charlie" was the hero and this particular tool the villian. It seems that Charlie was turning a piece of iron in a lathe that stood before an open window on the Ferry St. side of the building. Either there was a seam in the iron, or Charlie for an instant forgot his responsibilities, for the end of the tool suddenly flew up and fetched him a resounding thwack under the ear that nearly laid him out cold, after which it sailed merrily out of the window and landed among some kids that were playing in the street, scaring them into flight.

It took some moments and much sympathy and advice from his shopmates to restore Charlie's equilibrium but when his head had cleared sufficiently to allow him to navigate he went out into the street to retrieve the tool. As he stooped to pick it up a large lady of Hibernian extraction appeared suddenly from behind a nearby tree and commenced to belabor him unmercifully with a horsehide strap; calling him between blows a "dirty spalpeen that c'uldn't let the little childher play widout t'rowin' t'ings at 'um." It required the combined office and shop forces to effect an armistice.

After a job was roughed out with the hook-tool the latter was exchanged for a long-handled square-nosed tool which would be pushed along the top of the rest with the hand, reducing the humps to the diameter of the hollows left by the hook-tool. Although this finishing tool was not quite so erratic in disposition as its predecessor it still required a firm hand and a skill born of long experience to do a creditable job.

Skill Required in Threading

Threading was done with two tools made especially for the purpose. The first was a graver, having a single sharp point with which the lathesman would "start" the thread by a dexterous twist of the wrist, running up a turn or two on the work. Here, too, only the skill of the practiced artisan would suffice, for there was nothing but the movement of his hand guided by his eye to establish the lead.

When a partial thread of one or two turns had been cut, the "chaser" was brought into service. This would be a tool having several "teeth" of the exact shape and pitch of the required thread. The first turn or two cut by the graver served to start the forward movement of the chaser and it was up to the workman to continue the same relative rate of advance as he made pass after pass over the work until the teeth of the chaser had gotten sufficiently deep into the metal to guide itself. By the time the thread had been cut to half its depth the chaser would of course be guided by its own accurately pitched teeth, not only insuring the regularity of the threads but correct the slight inaccuracy of the starting threads cut by the graver. Capscrews, bolts, studs, etc., were not then available as a commercial product, therefore the making of these small but important items was a stock job to be followed up whenever work ran slack, or inclement weather kept the workers indoors.

Blacksmithing was a fine art and not a few parts came, all finished and ready to take their place in the machine, from the anvil. The good machinist was also blacksmith, carpenter, millwright and pattern maker; not infrequently foundryman as well. The broad axe or the sledge; the plane and the bit-brace, or the ham-

mer, cold-chisel and file; they were all his familiars and together with hook-tool and graver he was expected to handle them indiscriminately and with equal skill. It was emphatically the day of the "all-round man."

Crude Tools, but Accurate Work

Notwithstanding the crude tools, creditable jobs were the rule. The skilled craftsman would leave a journal as smooth and as parallel as would the average present-day mechanic; or would cut threads that looked as smooth and even, and served their purpose as well, though probably were not as accurately to pitch, as threads cut upon a modern engine lathe.

They did not talk about "splitting tenths" in those days; they split sixty-fourths instead, and a man who could turn a piece to "half a sixty-fourth was a good workman." Yet, when it came to making a fit with wire gage and caliper they worked as close in 1850 as they do in 1920; only they did not know it.

The principal line at the Renton shop in its earlier years was the building and repairing of steamboat engines, but with the rise of the steel and iron industry in Pittsburgh the work gradually changed to the new and heavier machinery required by the mills and furnaces.

Doing Jobs Outside of the Shop

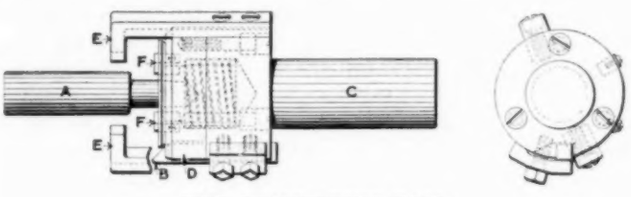
The size of a shop was no gage of the size of the work it could handle. Many a job that was too big to come in the front door was successfully accomplished upon improvised rigs mostly made of wood and set up outside. I was told of the boring of large cylinders set vertically in timber cribs in the street; a boring bar babbitted in place; boring head and cutter adjusted and a long pole made fast to the upper end of the bar. A mule attached to the free end of the pole furnished the motive power and a boy, riding on the pole near the center of activities, furnished the feed; varying the monotony from time to time by taking a whack at the mule with a long-handled ox-goad.

Chamfering Attachment for Hand Screw Machine

By Walter Symes

We had a quantity of punched washers to be chamfered, and the attachment here shown was designed to be used in a hand screw machine. It worked very successfully and we think it may be of interest to others.

The arbor *A* is made of tool steel, hardened and ground. It is held in a draw-in collet in the machine



THE CHAMFERING TOOL

spindle. The end is ground to a slight taper to allow it to enter the washer easily and still be tight enough to drive.

The cutter *B* is held in a shank *C* by a suitable clamp. The shank is made of machinery steel and carries the disk *D* which is made of machinery steel, casehardened and ground smooth on its face. The disk serves to hold the washer on the arbor by spring pressure and also acts to steady it while the tool is cutting.

The fingers *E* are for removing the washer from the arbor when the operation is completed.

The washer is dropped on the springs *F* which are fastened to the disk and which are made to suit the size of the washer. The turret is then brought forward so as to force the washer on the arbor and the forward movement, continuing after the washer has gone on as far as the taper will permit, forces the disk *D* back against its supporting spring, thus having the effect of projecting the tool to cutting position.

The turret is then withdrawn and the washer is engaged by the fingers *E* which remove it from the arbor whence it drops off into a suitable receptacle conveniently located.

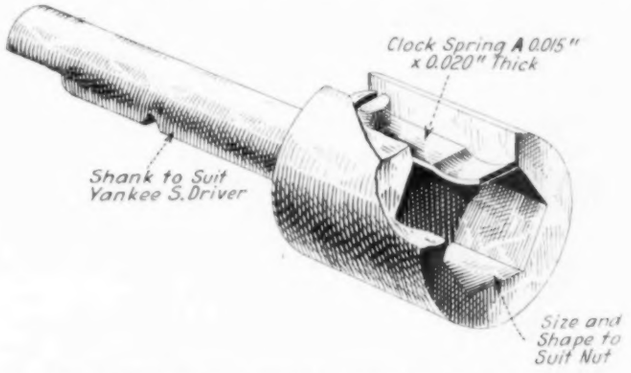
This attachment may be used for various sizes of washers by making arbors and springs to suit.

It is possible to chamfer 40 washers per minute.

Setting Small Nuts in Assembly Work

By H. S. Beeston
Notts, England

The writer noted with interest the article by Amos Ferber on page 739, vol. 52, of the *American Machinist*, describing the setting of small nuts in the assembling



TOOL FOR SETTING SMALL NUTS WITH A YANKEE SCREWDRIVER

of electrical devices by means of the sensitive drill-press and the tapping attachment. Having been directly connected with the assembly of electrical instruments for the past six years I can testify to the necessity for using tools of this class in order to keep abreast of the demand for production.

For the same purpose as outlined by Mr. Ferber in the above-mentioned article I have used the simple device herewith illustrated, fitted to the driver socket of a "Yankee" screwdriver, finding it quite as rapid as using a drilling machine and having the advantage of portability so that it may be used wherever convenient.

When used for setting small hexagon nuts the tool is made with a hexagon recess to fit the nut, and having one flat cut away to accommodate the spring (made from a piece of clock spring) that enables the operator to pick up and hold the nuts to be assembled. A downward push on the handle of the "Yankee" serves to spin the nut to place and set it up tight.

I have found this tool, used in this way, to be a production booster.

Your Liability for Concurrent Compensation

By CHESLA C. SHERLOCK

Not all of us—executives or workmen—fully understand the provisions of the workmen's compensation acts. The compensation allowable for various degrees of injury, resulting from the same accident, is explained in this article and the decisions of the courts of several states are furnished for reference.

THE other day a large employer of labor asked me this question: "For goodness sake, don't our liability ever end under the workmen's compensation acts? We always thought that when a workman was injured in his line of duty that we owed him compensation, but what happens when a workman receives two injuries from the same accident? Do we have to pay him double compensation?"

This is a question which has concerned not only the employers; it has greatly concerned the commissions and the courts administering the compensation laws.

The compensation acts have been unfortunate in their wording and in the plan used to provide for compensation to injured employees. It was the aim of the compensation acts, we will recall again, to take the place of the common-law theory of damages, and to remedy some of its evils.

And some of these evils which had worked the greatest dissatisfaction with the laboring classes were the uncertainty and the indefiniteness of recovery and the amount thereof. The compensation acts were to be certain and fixed in the fact that *some* recovery could be had, and definite in the *amount* to be recovered, so far as possible.

The framers of the acts provided a schedule to cover every kind of an injury they could think of. They then were faced with the conclusion that many workmen are injured and incapacitated who do not suffer any of these scheduled injuries. What were they to do with them?

In order to cover *all* cases they put in a provision which said in effect that anyone suffering an injury not listed should have compensation during the period of such disability not exceeding, however, a certain limit as to time and amount.

So we find that it is entirely possible for a workman to receive an injury arising out of the same accident which would raise a question as to whether he could force his employer to pay him as if he had, in effect, suffered two separate and distinct injuries arising from two separate accidents.

Law Does Not Allow Double Compensation

Does the compensation act in your state permit a double recovery for any given injury? It does not. Let that point be kept firmly in mind from the very beginning of this discussion. The law has never willingly permitted one person to collect the same debt twice, if it could help it. That is why, when the compensation acts were adopted, all recourse under the common law was cut off, and this provision made: That in case a workman should be injured under circumstances which gave him a right to both compensation and an action for damages under the common law, he was forced by the law to make a choice, to decide which branch of the law he wished to invoke, and having made his choice he had to abide by it.

If there is any employer who has been in doubt on this subject, let me bring to his mind at this time the fact that if he is operating under the workmen's compensation act that liability, in so far as his employees covered thereunder are concerned, does not extend to the old common law also. He need have no fear of suit at law for damages in addition to compensation. That right no longer is extended to his workmen. On the other hand, if there are workmen not covered by the compensation act in his employ who have a right to sue him for damages in case of injury, he cannot be called upon to pay them compensation also. The law is settled on this point and the employer's liability is single, not double.

The question we are discussing now is not with relation to a double liability as between the compensation acts and the old common law, but with reference to a double liability as under the compensation act alone.

Workmen are not to blame ordinarily if a single accident arising out of and in the course of the employment inflict several separate and distinct injuries upon them. If a workman loses a foot, for instance, he is entitled to a certain number of weeks' compensation under the schedule. He is entitled to it whether the disability in fact extends that far or not, for the law has presumed that such is the extent of the disability. Suppose, in addition, that the same accident causing the loss of the foot severely wrenched and lacerated his shoulder so that he can't stand erect or even sit up and must lie in bed on account of it.

The loss of the foot is a single injury and the incapacity resulting therefrom is partial and permanent. He will never have another foot. The injury to the shoulder is total but in time it will heal and the incapacity from such injury will pass away. So it is said to be a total temporary disability. It also is separate and distinct and is a compensable injury under the acts. Both, however, sprang from the same accident.

The employer complains when the workman moves for compensation for two injuries from the same accident. He claims that the workman is trying to recover double compensation for the same injury. He also states that he is charged to pay on the basis of accidents, not on the basis of every separate and distinct injury that the technicalities of the law or the genius of lawyers can discover for the claimant.

This is not an isolated or fanciful case which I have mentioned. It is one which has greatly concerned thousands of employers everywhere ever since the first compensation acts came into being ten years ago. Likewise it is one which has challenged the attention of the courts and commissions on many, many occasions. It is only within the past few months that any sort of definite conclusion has been reached by the authorities, and employers should feel gratified that at last some light is to be shed on the subject.

I have witnessed, while serving on an industrial commission, this question decided in several different ways, so I am not surprised to find that many of the states are still far apart on it. New York, for instance, decides the matter exactly the opposite of Connecticut and Indiana.

The Connecticut Law

In Connecticut, a case came up where a workman had sustained the loss of a leg and also an injury to a shoulder in the same accident. The headnote to the case states: "Under the Workmen's Compensation Act where a workman sustains the loss of a leg and also an injury to a shoulder in the same accident, resulting in partial incapacity, compensation may be awarded for such partial incapacity in addition to the specific indemnity provided for the loss of the leg."

Elsewhere, in the same decision, it is said: "Where an employee entitled to compensation under the Workmen's Compensation Act for partial incapacity to his shoulder and to specific indemnity for loss of a leg, sustained in the same accident, the trial court, inasmuch as the act does not permit double compensation, correctly made the awards consecutive, the award for total incapacity to precede in payment that for the partial incapacity."

Let us keep in mind this distinction made by the court between "concurrent" compensation and "consecutive" awards. The Connecticut court admits that the Connecticut act does not permit double compensation and seems to say by inference that to compensate two injuries *at the same time* would be to violate the law, but it sees no objection in paying for the two injuries at separate times.

Considered in a technical sense every workman suffers two injuries and the time limit imposed by the compensation act upon them must run concurrently, but the payment by the employer for them cannot run concurrently. This is a safeguard reacting to the benefit of the employer.

Let us be specific: Every injury results in a temporary disability. It may last but an hour, a week or a month, and this temporary disability is present whether a permanent injury is sustained or not. A workman is injured by the breaking of a belt in a shop. It strikes him in the side and wrenches an arm. He suffers a temporary disability because of the shock, the bruises and the wrenching. It may keep him in bed for three months. Suppose that in addition it causes him to lose the fourth finger of his hand. For such injury we will say that he is entitled to 40 weeks' compensation. The temporary disability due to the lacerated arm runs concurrently with the permanent disability suffered by reason of the loss of the finger. The employer pays first for the greater injury, the loss of the finger, and when the 40 weeks are up the temporary disability has disappared and he is, therefore, called upon to pay no compensation for it.

But suppose, and it was in a case of this kind that my friend made his protest, that the temporary disability exceeds the permanent disability in point of time, what then? Suppose the workman wants his awards paid concurrently? Under the law he cannot have them paid concurrently, but he can have an award made concurrently for both injuries, but the best he can hope for is to have them paid consecutively, and in some states, particularly New York, he cannot have them even paid consecutively.

In New York, it was shown that the workman's right hand had been injured, the second finger being cut off and the thumb and index finger severely lacerated. The commission found that "claimant was totally disabled for 10 weeks and awarded 8 weeks' compensation (minus waiting period) and then awarded 30 weeks' additional compensation for the loss of the second finger, to begin at the expiration of the 8-week period."

The supreme court reversed a decision of the appellate court upholding this award on the theory that the New York act was not indemnity for the loss of a member as such but compensation for disability to work on the basis of average weekly wages.

Said the court: "Concurrent awards and consecutive awards on separate items of physical impairment, disconnected from earning power, alike ignore the fundamental principle that the basis of compensation is a sum payable weekly for a fixed time during which the employee is actually or presumptively totally or partially disabled and nonproductive. All compensation acts have their foundation on the failure of the common law to provide a remedy for accidental injuries where the employer was not at fault, and both right and remedy thereunder are unknown to the common law. . . . While it may be urged that the law says that 'compensation . . . shall be payable for injuries sustained' and that injuries are recognized by law which do not necessarily impair earning power for any fixed period, such as 'serious facial or head disfigurement,' the schedule of compensation refers to disabilities only, and to compensation in case of disability only, and, so far as compensation is allowed for injuries which do not have any relation to disability for the full period for which such compensation is allowed, such allowances are the anomalies and not the characteristics of the statute. Any loss of physical function detracts potentially from earning power, and the Legislature is therefore justified in establishing a fixed period of compensation based on a specific injury such as the loss of a finger. If the injury detracts more or less from the earning power than the period fixed by the statute, it may at least be said that the rule is simple and the scale of compensation definite. The word 'disability' in the law as we read it, therefore, means 'impairment of earning capacity' and not 'loss of member.' . . . The entire matter is committed to the legislative discretion . . . which has not seen fit to provide for concurrent . . . or consecutive compensation. If the act is not sufficiently broad in view of the fact that it covers negligent as well as non-negligent injuries, we may not disregard its provisions to deal more scientifically or justly with the subject."

The Law in Other States

However, in Minnesota, a case arose where a workman lost a thumb and index finger of his right hand. For the thumb he was entitled to 60 weeks' compensation and 35 weeks for the index finger. The court made the payments run concurrently. The case was remanded by the supreme court for modification, the court pointing out that as the claimant had sustained two separate and distinct injuries if awards were made to run concurrently the amount payable weekly for 35 weeks would be $15, or a sum greater than that allowed under the statute.

Said the court: "This feature of the statute cannot be ignored, or the particular provisions brushed aside as unimportant. It must be recognized and effect given

thereto. But this can be done only by requiring payment for each injury separately during the period prescribed by the statute, one to follow the other. That would not violate the maximum either as to amount or the limitation of time."

Here, again, the court had no quarrel with the thought of a double award, but merely as to the manner of payment.

In Indiana, it was held that an employee who has sustained two or more injuries in the same accident, one of which is compensable under the specific schedule for permanent partial disability, and the other or others are compensable under another section, as for temporary total disability, compensation may be awarded under the specific schedule for permanent partial disability, and also as provided in other sections for temporary total disability, but that such awards should run consecutively and not concurrently, not, however, for a period to exceed 500 weeks as provided by the act, or for an amount exceeding $5,000 as provided by section 40 of the act.

The court said: "To determine that in cases such as are involved here the periods of compensation should run concurrently would, in our opinion, violate the spirit and the purpose of the act. It is therefore our judgment that in such cases compensation should be awarded at the 55 per cent rate, and that the periods should run consecutively, but not to extend beyond 500 weeks, and that the amount of the compensation should not exceed $5,000."

Again the Connecticut court has said: "An injury attended with blood poisoning might incapacitate for an entire year, and the injured person would be entitled to compensation for that period, provided no amputation were necessary; but if such injury was attended with the loss of a small toe or the phalanx of a fourth finger, compensation would be from six to thirteen weeks. Our act does not permit double compensation, and hence the trial court was correct in making these awards consecutive; the award for the total incapacity to precede in payment that for the partial incapacity."

It is useless to quote the courts further on this subject. The decisions based above are all from courts of last resort in the respective states mentioned and they are authoritative.

The courts, with one exception (New York), take the position that concurrent compensation cannot be awarded and no employer is liable therefor, but they see no objection to awards for separate injuries springing from the same accident, provided the employer is asked to pay for them in consecutive payments, the award for permanent partial disability, or scheduled injuries to be paid first.

The New York court, however, seems to consider "concurrent" and "consecutive" awards as one and the same thing; that if one is not permissible under the law the other should not be.

No matter what act you operate under, there is no room for the feeling that the compensation acts call upon you to pay for the same injury twice. Even in those states permitting "consecutive" payments you do not do that; you merely pay for the effects of the one accident, in its relation to the whole amount of disability actually caused the injured workman.

There is nothing unfair about it, under either construction. It is an attempt merely to harmonize the two diverse sections of the statute and to render unto each man—the workman and the employer—his due.

Is This a Punch Press Job?

By C. M. STARR

On page 372 of *American Machinist*, under the title "Is This a Punch Press Job?" is an article which offers a solution to the question previously raised by F. C. Hudson, on page 1267, Vol. 52.

I think a better and easier way to do this work would be by means of the little rolling mill shown in the illustration, which represents a device that I made several years ago for work similar in kind but different in section. This device was made for and used in an ordinary engine lathe of about 21-in. swing.

Referring to the drawing the letter *A* represents four boxes or bearings of cast iron, planed square in all directions, and bored through the center to take the 2¼-in. journals of the arbors which carry the rolls. The boxes are held together in pairs by two bolts to each pair; thus providing a means of adjustment to maintain the required pressure on the work.

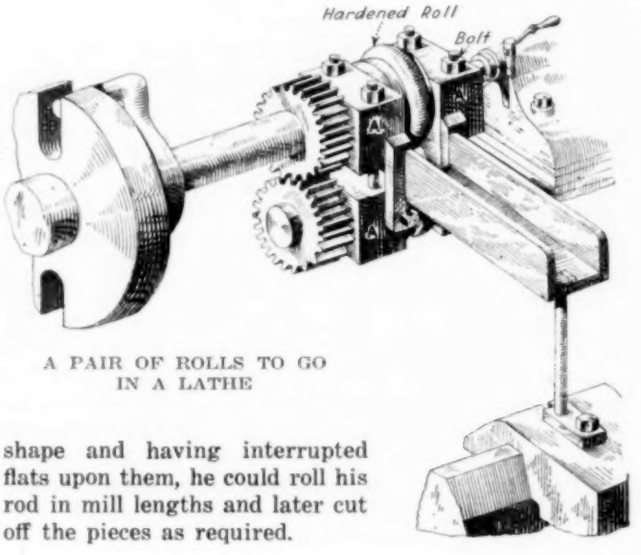
One arbor is made longer than the other and has generous centers, so that the device may be placed in the lathe, by which it is driven through the medium of the regulation lathe-dog. A pair of gears suitably mounted serves to drive the lower roll.

A spout or channel to guide the metal to be worked is firmly screwed to bearing blocks of the lower roll and a swinging strut pivoted under the spout fastens to the cross-slide of the lathe carriage and prevents the whole device from turning over with the lathe.

The rolls are of machinery steel, deeply carbonized, made glass hard, and must be polished to a mirror finish in order to make them do good work. They are threaded to the arbors, one right and one left hand, against a shoulder and should be plainly marked right and left so that there need be no guess-work when it becomes necesasry to remove them from the arbor, for they start hard.

It is a matter of a very few minutes to set up or dismount this device in a lathe and it can, therefore, be used to advantage in any lathe big enough to drive it at such times as the lathe is not needed for other work. With the backgears in, a very powerful drive is secured.

The shape of the rolls shown in the cut is not adapted to Mr. Hudson's work, but this is, of course, but a detail of construction. With rolls of suitable shape and having interrupted flats upon them, he could roll his rod in mill lengths and later cut off the pieces as required.



A PAIR OF ROLLS TO GO IN A LATHE

Franklin Transmission Case

BY FRED H. COLVIN
Editor, *American Machinist*

The transmission case of the Franklin car is an aluminum casting, as can be seen from the various illustrations. The machining operations involve a number of interesting milling and boring operations, some of the fixtures being of particular interest on account of some of the features of their somewhat unusual design.

AS in the machining methods of most pieces of this type, the first steps are to face-grind the top of the casting, drill the bolt holes and ream two of them to be used for locating points in all future operations. After this is done, the transmission cases go to the double-headed milling machine shown in Fig. 1, for the rough milling of the ends of the case.

The string fixture shown holds four of the cases at one setting, each case being located by two dowel pins, the face on the fixture squaring the castings with the faces which have been previously milled. These fixtures are very quick acting, the work being held down by five straps, one at each end and one between each of the castings. These straps are double ended but do not bear directly on the casting itself. Instead of this, the ends of the straps bear on the hook or angle plunger *A B*, the cam *C* locking them securely in position. For removing and replacing the work, the hooks can be swung out of the way, each being provided with a round body as can be seen. These, in connection with the quick acting cam *C*, enable the cases to be quickly handled on and off the fixtures.

The inside faces of the idler gear bosses are machined by means of the device shown in Fig. 2, the machine used being a substantial hand milling machine which is very convenient for work of this kind.

The cutter *A* is driven by gearing from the milling machine spindle, the gears being protected by the plates *B*. The transmission case is held against the angle plate *C*, by means of the strap *D* and the hand screw *E*. The stop *F* positions the strap *D*, and prevents it being swung up too far before locking in place. The case is positioned on the angle plate by dowel pins in the reamed holes.

An interesting combined boring and drilling machine is shown in Fig. 3, which takes care of all the holes in the ends of the case. Nearly all of the boring bars and drills can be plainly seen, the large boring bars being of the Davis expanding type while other holes are bored and drilled by the spindles and tools shown. It will be noted that the fixture holds two transmission cases, but that each set of spindles is at work at a different end of the case. The first set of spindles bore and drill one end and after the piece is removed, its po-

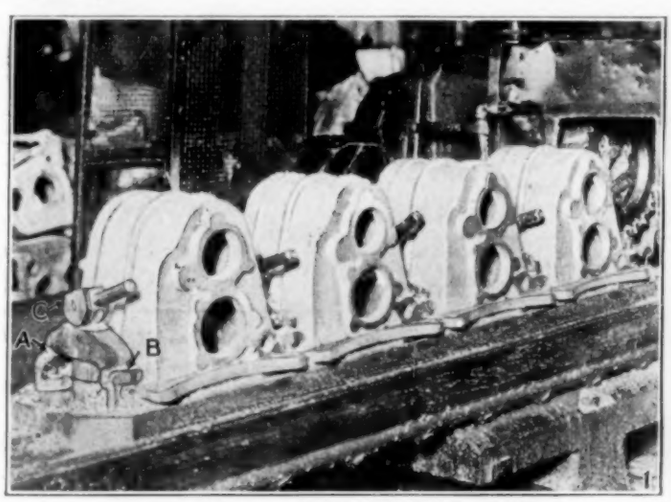


FIG. 1. MILLING ENDS OF CASE

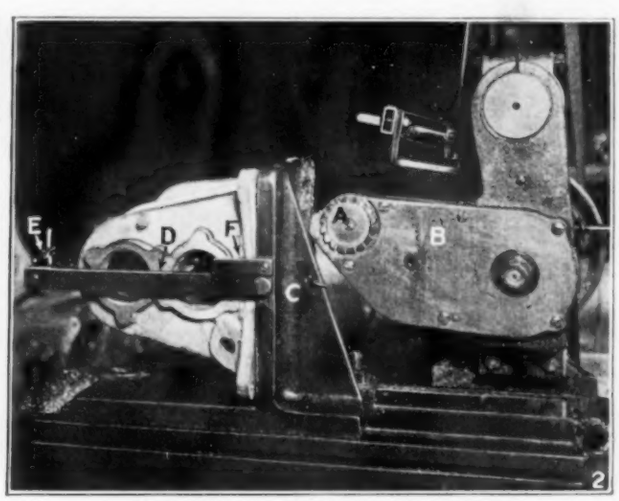


FIG. 2. INTERNAL MILLING DEVICE

AUTOMOTIVE CONSTRUCTION

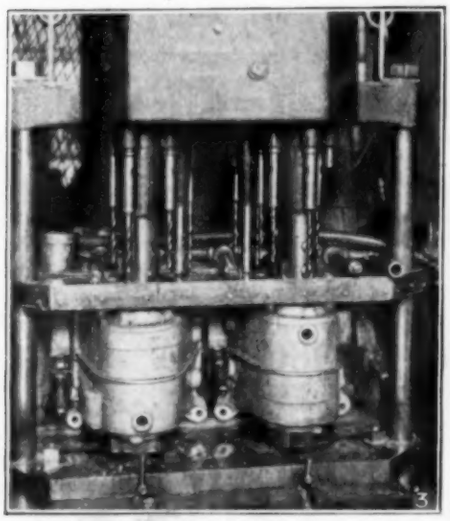


FIG. 3. BORING AND DRILLING CASE

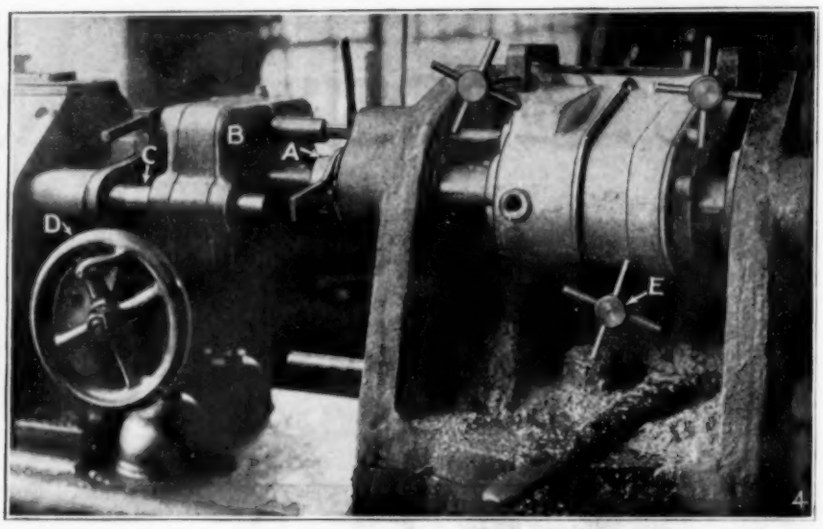


FIG. 4. FINISH BORING OPERATION

sition is reversed and placed in the second fixture, a new piece to be machined being ready to take its place.

This fixture uses a type of clamping fixture very similar to that shown in Fig. 1, where the lever can be seen between the cases.

After drilling and tapping the bottom of the case is milled to insure clearance of the transmission gear. Then the case goes to the fixture shown in Fig. 4 to have the four bearing holes reamed as well as to ream the hole for the shifter fork. The work is done on a special machine. The boring bars are driven from the central spindle *A*, which comes through the gear box *B*, the whole box sliding on two rods, one being shown at *C*. The boring bars are supported in the substantial fixture which holds the transmission case and suitably guided by removable bushings. The boring bars which impart motion to the gear case *B* are fed by the hand-wheel *D*.

The case is located by dowel pins in the usual manner, and held in place by the three clamping screws shown. The lower screw *E*, operates a regular strap clamp, while the two upper screws form part of special C-clamps.

Two other milling operations are shown in Figs. 5 and 6, each of which involves the use of a fixture of different type. The first operation is on a Kempsmith and the latter on a Becker vertical machine. In Fig. 5, the transmission case is located by the four corner holes and held in position by the arms *A* and *B*, which can be swung up into place or dropped entirely out of the way, as desired. The two hand-screws *C* and *D*, each provided with a large cap having a flat surface to

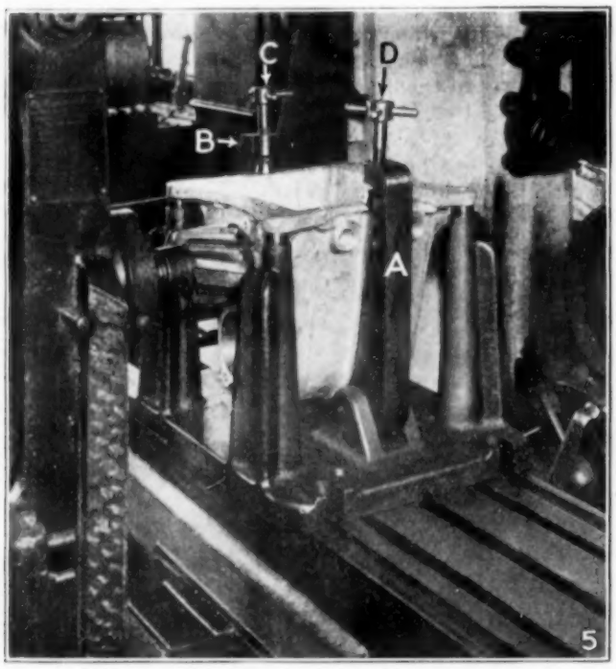


FIG. 5. FINISH MILLING ENDS

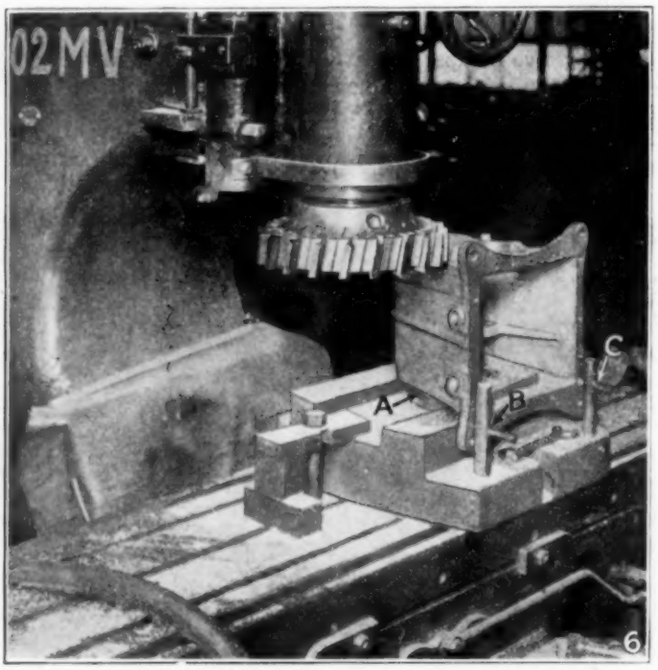


FIG. 6. VERTICAL MILLING OPERATION

AUTOMOTIVE CONSTRUCTION

FIG. 7. GRINDING THE COVERS

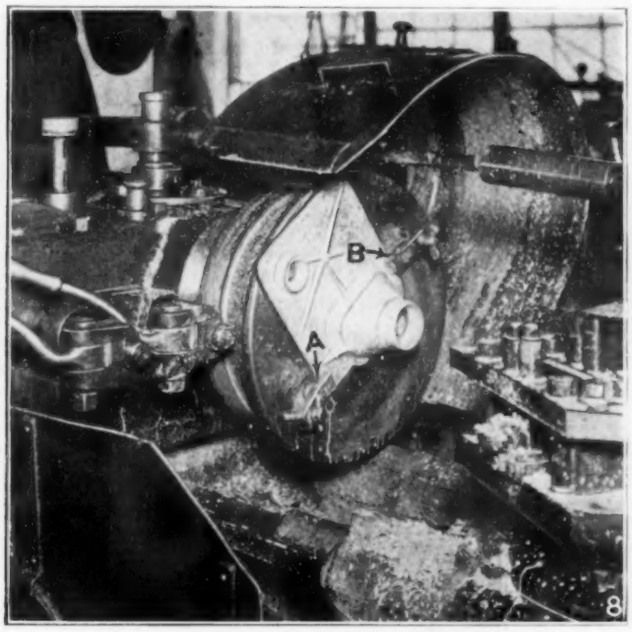


FIG. 8. BORING FOR THE LEVER

prevent marring, hold the case firmly in position during the milling operation.

In finish milling the side of the case, the casting is positioned by a stud at *A*, Fig 6, which enters the lower shaft hole, while the two post positioning screws, *B* and *C*, locate the case in the other direction.

Machining the transmission case cover, begins with grinding the bottom surface, on a Blanchard machine, as shown in Fig. 7. This view also shows the type of clamp used, it being necessary to have the clamp bite into the edge of the plate in order to hold it with sufficient firmness and, at the same time, keep the clamping jaw out of the way of the grinding wheel.

This view also shows how three covers are ground at one setting, by being placed around the revolving table. The fixtures are held in position by a magnetic chuck, which forms the working table.

Then comes the drilling of the bolt holes, spot facing the holes, and the operation shown in Fig. 8, which bores the hole forming the opening for the transmission gear shifting lever. This is a 2.25-in. hole with a tolerance of 0.002 in. while the outside is turned 2.625 in. and threaded sixteen per inch. The method of clamping the cover to the special faceplate is by means of the clamps *A* and *B*.

The under side of the cover has a slot $\frac{5}{8}$ in. wide by

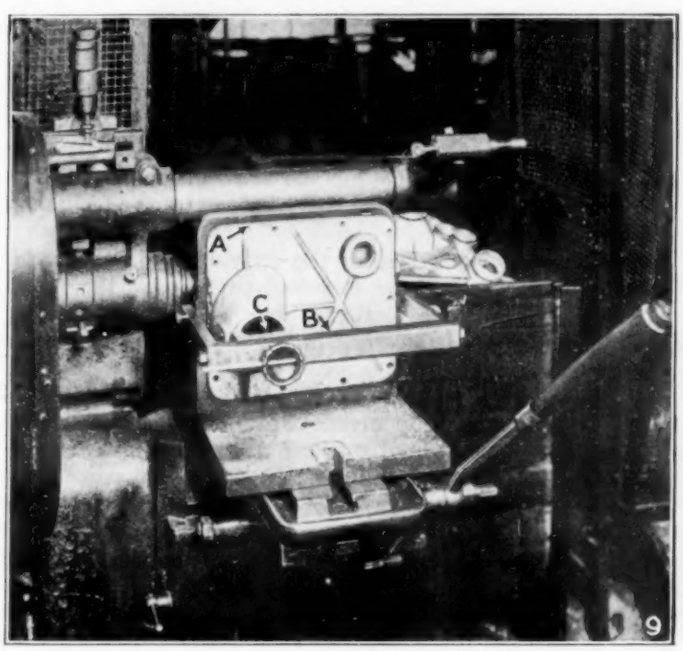


FIG. 9. MILLING RECESS IN COVER

FIG. 10. GRINDING THE EDGES

2⅛ in. long, which is cut on the hand milling machine shown in Fig. 9. Here again, the cover is located by dowel, one being shown at *A;* and held in position by the swinging arm *B* and the clamp *C*. Then there is back facing, drilling and boring, after which the side is ground to size on a Gardner grinding machine as shown in Fig. 10. This finishes the operation, after which the cover is ready for the assembling department.

Solving Poland's Industrial Dilemma*

By HENRY ANIELEWSKI
American Representative of the Polish Mechanics' Co.

POLAND today is seeking to break the "vicious circle" of economic handicaps that is retarding industrial development. The nation needs money and raw materials in order to restore the full output of the mills and factories; the nations which possess the money and supplies are reluctant to make advances until the mills and factories are fully productive.

The most successful attempt so far made in solving this problem is through workmen's co-operation—the co-operation and full accord, not only of the workingmen of Poland, but of their Polish-American brothers as well. Under this plan the laborers in Poland will operate the factories, and their fellow workers on this side of the Atlantic will provide the initial capital and the necessary equipment.

MAIN ASSEMBLING ROOM AND MACHINE SHOP OF THE POREMBA PLANT

In carrying out this idea over 12,000 Polish-Americans have joined in an effort to assist Polish factory workers, and with them have organized the Polish Mechanics' Co. Though formed less than a year ago, this mutual benefit association is now operating two large machinery factories, one at Pruszkow, near Warsaw, ond the other at Poremba, in the heart of the Polish coal region.

This company is merely one of numerous co-operative organizations now functioning in Poland, but as it has most completely co-ordinated the efforts of Poles and Polish-Americans, a description of the progress made by this company may be taken as representative of the possibilities of mutual benefit establishments which avail themselves of the abilities of both the Polish workers and the small American investors.

The Polish Mechanics' Co. was incorporated in Ohio last year with a capital of one million dollars. American citizens living in 186 communities joined in financing the organization, and within a few months over 12,000 individuals had subscribed to the company's stock, the holdings varying in size from one to sixteen shares with a par value of $100. The truly representative character of the company is well indicated by this wide distribution of the capital holdings, no small group of individuals being in a position to manipulate the concern's affairs.

The actual direction of the company is in the hands of officers elected for one-year periods by the stockholders. In these elections both the Polish-American stockholders and the workers in the Polish factories are given representation according to the extent of their paid-up investments. To date the greater portion of the company's supporters are American residents, though the number of workers will be increased as rapidly as the business of the factories is expanded. All the workers in the two factories now in operation are interested in the company's finances, though a great number have not yet paid up in full the few shares of stock issued to them. There are now about one thousand employees on the company's payroll.

Nearly all the skilled workmen now employed in the Poremba and Pruszkow plants received their mechanical

*Reprinted from the October issue of the *Journal* of the American-Polish Chamber of Commerce and Industry.

training in American steel plants. The efficiency they acquired while in the United States has had a marked effect on the output of the factories. The adoption of American methods throughout the company's holdings in Poland is proceeding rapidly, the returned American workers being engaged in instructing the Poles in the most modern methods.

Shortly after the formation of the company and following the adoption of a definite plan of action, I was sent in February of this year to organize the proposed establishments in Poland. The first purchase for the account of the company was an industrial plant at Pruszkow. The immediate task presented was the restocking of the plant's equipment, much of the machinery having been carried off by the Germans during their period of occupation. Slightly over $250,000 worth of toolmaking machinery was purchased for this purpose in the United States and shipped at once to Poland, where early in the summer the preliminary installations were made in the newly acquired factory.

The disorganized state of the railroads proved to be a severe handicap to the factory because of its location in a region somewhat remote from the coal mines. To overcome this hardship, the company decided to acquire an additional plant located nearer the source of both the coal supplies and other mineral raw materials. At Poremba, near Zamiercie, in the southwestern section of Poland, a large and well-equipped industrial plant was purchased from a German-Jewish concern. Before the war this property had been valued at five million rubles, or two and one-half million dollars. This establishment, with its foundries, shops, Bessemer equipment, and other departments will accommodate 3,000 employees.

At the present time 850 workmen are employed. They are now engaged in the manufacture of war materials, but arrangements are being perfected for the making of tools and factory machinery as soon as Poland no longer requires munitions. Sixteen coal concessions are controlled by this plant, and the greater portion of them are now reaching normal production.

In acquiring this property, the Polish Mechanics' Co. fell heir to the town of Poremba, located on the company property and inhabited solely by the factory employees. The co-operative plan is thus in this case carried, not only to the production end of the business, but to the home life as well. All the town's stores are run on the mutual benefit plan. The homes are modern and sanitary and are turned over to the employees, who are in fact all partners, at very small rentals.

The co-operative idea in Poland is growing spontaneously among the peasants as well as among the industrial workers. Near the city of Krosno there is a factory under construction for the manufacture of linen goods. The entire project is in the hands of 8,000 peasants who live in the neighborhood and who have joined in an effort to control the finishing of the raw linens.

The Polish Government is giving aid to all essential industries, and has provided for priority in shipping rights to firms engaged in the manufacture of necessities. The department of commerce and industry which is now being formed will soon be in a position to cooperate extensively in improving transportation conditions, helping develop new markets, etc.

A letter which I received from the general staff of the Polish army further indicates the support that is to be expected from official sources in the re-establishment of Polish industry. The letter follows:

"The general staff gladly defines its standpoint with regard to the progress of domestic industries in Poland and asks you to communicate these views to our countrymen in America, and especially to all members of the 'Polish Mechanics' Co.'

"In view of the success attained through the complete co-operation of all units in the Polish state during the defense against the Bolshevik invasion, the supreme command, general staff, believes that thorough-going co-operation in industrial associations will result in the earliest possible restoration of the nation's production.

"Though the general staff is heartily in favor of official aid being given Polish industries, it yet believes that the slogan of the nation should be 'Private enterprise must initiate, the state must render aid.'

"With this idea in mind, the general staff is giving its support to the domestic industries which are based upon the sound democratic principle of workers' co-operation. In lending its aid to industrial establishments the general staff has in mind the development of a series of factory centers which in time of war could be quickly turned to the making of munitions and other supplies for the Polish army, and which in time of peace could first help restore those regions which suffered from the war and then in the general commercial upbuilding of the nation.

"The general staff is conscious of the fact that the co-operation of Polish-Americans with the workingmen of Poland may become a powerful means of opposing the invasion of Poland by German and Czech industries. The general staff believes that such a union will be one of Poland's most valuable foreign connections. The general staff will, therefore, support all honest efforts in that direction, and invites the Poles in America to an honest and sincere co-operation." (Signed),

By the order of the general staff,
MAJOR DOBRUCKI, construction chief.

Hardness Tests on White Metal Completed

Experimental work on determining the compression and hardness value of white-metal bearing alloys at temperatures up to 100 deg. C. has been completed by the Bureau of Standards, Washington, D. C. A paper has been prepared entitled, "Some properties of White-Metal Bearing Alloys at Elevated Temperatures," a summary of which is as follows:

An apparatus is described for determining the yield point and ultimate strength of white-metal bearing alloys at temperature up to 100 deg. C. A new design of heating apparatus is described for determining the Brinell hardness of such metals in the range of temperature indicated above. The results of compression tests and Brinell hardness tests at temperatures up to 100 deg. C. are given for five typical white-metal bearing alloys, including three tin base alloys, one lead base alloy and one intermediate alloy. These tests showed that the tin base alloys maintain their properties better at elevated temperatures than those containing lead. Results of tests are given which indicate that up to 3 per cent the lead in a high-grade babbit does not affect the yield point or ultimate strength at 25 deg C. or 75 deg. C. Tests are described which show that the yield point of tin base alloy is not affected by heating for six weeks at about 100 deg. C., but that the yield point is lowered in the lead base alloy by heating for only two weeks at this temperature.

Device for Handling Piston Rings in the Side Grinding Operation

By Amos Ferber

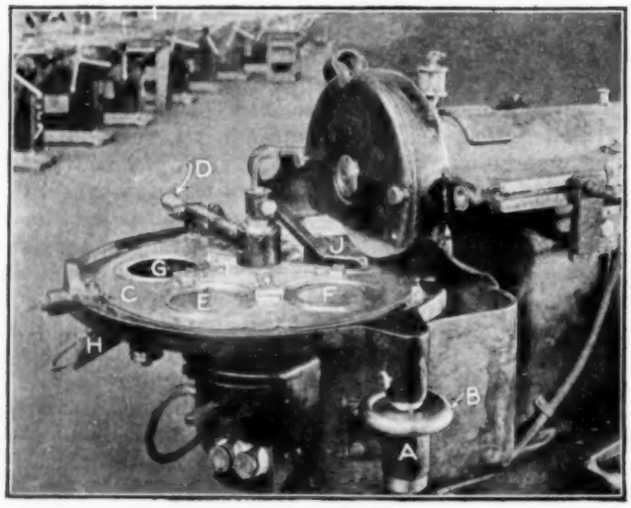
The rapid handling of piston rings in the side grinding operation on such machines as the Heald, involves a considerable degree of skill in accurately placing the ring on the chuck so that it will run true, and doing it in time to escape the advancing grinding wheel.

If the ring is badly centered the wheel may not cover the entire surface, or it may be swept out of place or broken; sometimes necessitating the stoppage of the machine to clear the chuck.

A device has been developed by the Heald Machine Co. to be applied to its machines which makes accurate centering a positive operation and machines can be operated continuously from the start by green operators, for nothing is left to the operator's skill or judgment.

The device is self contained and fastens to the standard machine by merely drilling and tapping a few holes in the splash guard to bolt on brackets, one of which is shown at *A*. The frame is supported by these brackets through the medium of elevating screws each fitted with a small handwheel *B* to provide for up-and-down adjustment.

The adjustment at this point is necessitated by the fact that the splash guard on a Heald machine does not move with the vertical adjustment of the work-holding chuck and, therefore, any change in thickness of work involves the extra adjustment of the device to meet the new level. The device is so adjusted that the disk *C* just clears the surface of the chuck.



FEEDING-IN DEVICE FOR USE IN GRINDING PISTON OR SIMILAR RINGS

The disk is revolved by means of the ratchet lever *D* which moves between permanent stops so arranged as to bring one of the openings in the disk concentric with the chuck. The operator lays a ring to be ground in the opening *E* and makes a movement, forward and back, of the lever, which carries the ring forward to position *F*. A second movement brings the work under the wheel.

The lever movements must of course be made in synchronism with the reciprocating movement of the wheelhead, which, as is usual in this class of work, makes and breaks the circuit to the magnetic chuck.

By means of this device the operator is relieved of any responsibility except that of laying a ring in the opening *E* and making the lever movement at the moment when the wheelhead is at the back end of its stroke. The disk centers the ring accurately on the magnetic chuck before the forward movement of the wheelhead turns on the current, and as the current is turned off as soon as the wheel clears the work on the reverse stroke there is nothing to prevent the moving disk from sweeping the ground ring off the chuck.

The operator has nothing to do with the removal of the work; the rings drop out upon reaching the position *G* and pass out through the chute *H* either to a box or to a rod arranged to receive them.

The holes in the disk are made large enough to take the largest diameter of work contemplated and are bushed for smaller sizes. The cut shows the machine set up in the service department of the Heald shop to grind ball-bearing rings considerably smaller than the holes in the disk. Bushings are therefore shown in place held by the small clamps *I*. The part *J* is a guard, attached to the fixed central stud of the device, and remains in the position shown, which is over the ring being ground. Its duty is to prevent the possible flying of pieces in case a ring breaks under the wheel.

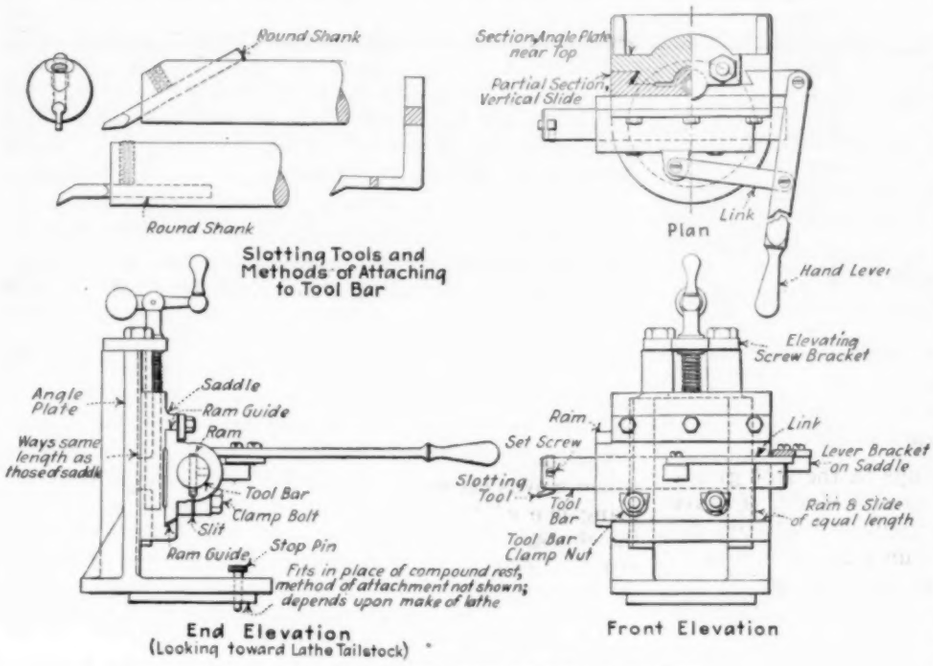
Slotting Attachment for the Lathe

By H. H. Parker

For general repair and experimental work, some means for cutting keyways in the hubs of gears and pulleys while they are still set up in the lathe after boring or machining would greatly facilitate the work. The illustration shows a small hand-power slotter which may be bolted to the cross-slide in place of the

compound rest, or, if practicable to cut the full width of the keyway at once, directly to the bed or ways of the lathe.

The attachment, while not of the "homemade" variety is of fairly simple construction and of substantial proportions. No dimensions have been given since these would depend upon the size of the lathe and upon the character of the work to be operated on.



SLOTTING DEVICE FOR USE IN A LATHE

First, there is an angle-plate casting which bolts to the cross-slide. It has a circular lower boss and this may be graduated similarly to the compound rest or else be provided only with a zero point, since in all probability the attachment would seldom be used for angular cutting. The vertical arm has sixty degree V-slides, cut away near the bottom to facilitate machining and to prevent the saddle from wearing a shoulder there. The vertically sliding saddle has horizontal ways similar to those of a planer cross-slide, the upper being flat and the lower a V-slide with gib. A boss to take the bronze or gun-metal feed screw-nut is cast on the back of the saddle and another on one side to act as the fulcrum for the operating lever.

A cast-iron ram, the same length as the saddle, which by the way has its slide the same length as that of the angle plate as called for by correct mechanical design, slides back and forth in the saddle when actuated by the lever. A round toolbar fits into a horizontal hole bored through the ram and is secured at any point by two clamp bolts which draw together the slotted casting. Thus for a short stroke the bar may be drawn well into the ram to take advantage of the greater stiffness. For use in a medium sized lathe, a maximum stroke of 2 in. would in most cases be sufficient combined with a vertical adjustment of about 4 in.

The transverse movement, when necessary, is furnished by the lathe crossfeed. As the device should be capable of being quickly and accurately lined up so that the ram movement will be parallel to the lathe bed, a hardened taper pin or other positive stop arrangement should be provided.

The operating lever works through a link and is fulcrumed on the saddle. Though it would be possible to arrange a power drive of some sort for such intermittent use as the attachment would ordinarily be put to, the hand lever is simple and satisfactory. Regular slotter type cutting tools are used; if there is room for the whole toolbar to enter the work, a tool held in a straight vertical slot in the end of the bar and clamped by a side setscrew is best. For a narrow keyway, a tool the full width of the cut will be used; otherwise the crossfeed will be operated to carry the cut the whole width. When the bore is smaller in diameter than the toolbar, the cutter can extend out from a hole drilled either horizontally or at an angle in the end of the bar, as shown in the sketches. Tools of drill rod forged to shape and hardened and drawn, with the shanks left round, will answer the purpose. Or a tool with a right-angle bend, clamped in the vertical slot, can be used for a short cut. One end of the toolbar can be made with a square vertical slot and the other end provided with the angular round one.

For satisfactory work all lost motion must be taken up by means of the gibs and a setscrew though other means for clamping the vertical slide might also be of value, but would hardly be necessary if the feed-screw makes an accurate fit in the nut and there is no play at the handle.

Repairing Broken Expansion Reamers

BY CHARLES HATTENBERGER

Some years ago while working in a small jobbing shop I noticed several expansion reamers that had been discarded because they were broken at the end of the slots. I repaired them all at small expense by winding over the broken section a layer of fine copper wire about

A REPAIRED REAMER

0.025 in. diameter. The reamers were put in the lathe, one end of the wire slightly bent and inserted in one of the slots, and the wire closely and tightly wound over the break.

Before relieving the tension on the wire a thin coating of solder was applied over the entire surface to hold it firmly in place.

The repaired reamers were then practically as good as new.

EDITORIALS

The Development of Aircraft

ENGINEERS returning from Europe tell us of the increasing activity in aircraft development on that continent which makes our own efforts seem of comparatively little consequence. True we have a few builders who are doing good work in the development of passenger carrying ships, but progress has been very slow for the nation in which the airplane first became a reality.

The British Government is giving considerable aid and encouragement to the development of aircraft, and the British Air Ministry is of real assistance by securing and placing at the disposal of British subjects all data regarding aircraft.

According to the British Air Ministry the last year saw 1,325 airplanes arrive in England from the continent. Of these machines 1,079 were British, 236 French, 9 Belgian and 1 was Swiss. The departing planes totaled 1,455, of which 1,206 were British, the difference denoting the planes flown over and sold.

These planes carried both passengers and freight (or express matter as we would call it), the latter amounting to $1,000,000 going out of Great Britain and $2,000,000 coming in. The planes carry this at a lower rate than the old method, small parcels costing ½ penny per pound as against 1½ to 4 pence formerly.

It is gratifying to learn that the British Air Ministry credits the United States Air Mail Service as being the most successful air mail service in the world. But if we are to maintain this supremacy we must continue to design and build better and more efficient planes, as this has a marked effect on the economy of operation.

We must not let prejudice stand in the way of advancement. The so-called Larsen planes, which are the German-made Junker planes, have proved their economy and efficiency in many ways. The cross-country mail flight to San Francisco and return was a severe test, and they met it in a very creditable manner. The unfortunate accidents due to fire from leaking fuel pipes, are details which should have been remedied by providing for the vibration which occurs in all planes.

The absence of parasite resistance in these planes makes it possible to secure from their power plants a fuel economy as good as that of many makes of automobiles. A motor of 160 to 180 horsepower does almost the same useful work in one of these monoplanes as is done in our ships of regular design by a 400-horse-power motor. The noticeable difference is in taking off from the ground and in the ceiling of the plane.

With the knowledge of this performance the logical procedure would be to duplicate or improve it, abandoning if necessary the older designs of planes. Mere criticism of the origin of the design or of the agency by which it came to this country is neither logical, broad-minded nor good business.

We have the facilities for both laboratory and practical tests of all kinds. We have, or ought to have, engineers who thoroughly understand the problems. We have opportunities for development which few countries can enjoy. With these we ought to be leading the world in all aircraft matters instead of trailing along as we seem to be doing. F. H. C.

A Vindication of Private Ownership

THE remarkably quick come-back of the railroads in numerous ways, is a source of gratification to those who know the fallacy of government ownership.

Those who know human nature—who have had experience in handling bodies of men—know that the *average* person has a tendency to "loaf" or "lie down on the job" if placed in a position where he is practically immune from discharge, where his remuneration is fixed and where there is no means of real discipline to make him produce a minimum amount. Such conditions are enervating and take away ambition. Government ownership invariably produces such conditions. The morale of the working forces of the railroads, as it was at the end of government control, proved it.

It is an inexorable law of nature that the disuse of any limb or faculty shortly produces atrophy or a shrinkage of it. Limiting a worker's productive ability below his normal capacity comes under the same law, and results in loss of initiative and morale.

When the railroads were returned to their rightful owners, there were thousands more workers on the payrolls than ever before—thousands more than even war-time conditions warranted. These superfluous, pampered extras had to be eliminated in order to get back to anywhere near real efficiency. Prompt action by far-seeing railroad officials is now producing results that should effectually lay the ghost of government ownership, so ardently believed in by impractical dreamers and scheming politicians.

The number of tons of freight moved one mile in August, was 42,706,000,000, the largest amount ever moved in the same time in history. It exceeds, by nearly 2,000,000,000 tons, the largest amount moved in war time under government control and with the help of thousands more men than in the instance cited.

This is all the more remarkable in view of the great number of "bad order" cars and locomotives which the Railroad Administration dumped upon the present operators, and then boasted of how *economically* things had been handled under its direction!

From statistics available at present, it is highly probable that the figures for October will considerably exceed those given for August. E. V.

A Study of Working Fits

AN INTERESTING piece of work is being undertaken by the American Society of Mechanical Engineers through its Sectional Committee on Plain Limit Gages for General Engineering Work. This committee, formed at the request of the British Engineering Standards Association for co-operation in that

work, is including in its work not only the question of gages themselves but of tolerances for manufactured material, the methods of gaging manufactured material and the limits and manufacture of the gages themselves.

The members of this committee have been carefully selected so as to include practical men from a variety of industries. Several of these men were closely connected with the manufacture of ordnance, both in the service and out, and are keenly alive to the delays which were encountered, due to an utter lack of any sort of standardization, or even of understanding, of working allowances and tolerances.

Being practical men they have no illusions as to workable allowances and tolerances, and no desire to force any specific tolerances on designers in general. It is their desire to secure from as many sources as possible, the practice of the country with regard to fits of different kinds. Such information does not prevent anyone from experimenting with other tolerances for special cases, but it can hardly help preventing many costly and unworkable specifications being made.

Furthermore it makes available a source of data which can be used to show what the best manufacturers consider to be good, standard practice. Such information will go far to prevent foolish, if not impossible tolerances being specified in many cases, particularly in government work.

This committee asks and deserves your assistance in every way possible. It asks your consideration of the following kinds of fits:

1. Loose Fit Class
2. Medium Fit Class
   - A. Running fits for high speeds (say 600 r.p.m.)
   - B. Running fits for lower speeds, sliding fits, etc.
3. Snug Fit Class:
   - A. The closest fit which can be assembled interchangeably by hand
   - B. Wringing fits where parts must be selected or fitted
4. Tight Fit Class:
   - A. Drive fit for light sections
   - B. Force fit for heavy sections
   - C. Shrink fits

The committee would like your opinion of these classifications and to know how they cover your own work. Later, more specific questions will be placed before you, but suggestions from any source will be appreciated by the chairman of the committee, Col. E. C. Peck, General Superintendent, Cleveland Twist Drill Co., Cleveland, Ohio. F. H. C.

Motor-Flywheel Drive for Merchant Mill

By T. A. Bryson
Tolhurst Machine Works, Troy, N. Y.

Captain Varela's discussion under the above title, on page 660 of *American Machinist*, would have been considerably clearer, at least to the writer, if the characteristic torque-speed curve of the motor had been illustrated. From the data and specifications given in the body of the article this curve may be partially constructed. Such a curve indicates that the arbitrary rating placed upon the motor is low, considering the power that it is capable of developing. In fact, the motor is called upon to develop an average power output considerably above its rating.

Considering the cycle of operation:
Peak load, 6,534 hp., lasting 0.87 seconds.
Friction load, 360 hp.
Interval between peaks, 2 seconds.

$$6{,}534 \times 0.87 = 5{,}685 \text{ hp.-seconds}$$
$$360 \times 2.00 = 720 \text{ hp.-seconds}$$
$$2.87 \mid 6{,}405$$
$$2{,}232 \text{ average hp.}$$

The flywheel merely performs the function of storing power and smoothing down the peaks. It remains for the motor to supply 6,405 hp.-seconds of power during the 2.87 seconds, or an average output of 2,232 hp., although it is rated at only 1,800 hp.

Further, the author computes slip at overload as if the slip were proportional to the load. This is difficult to understand, since the specifications call for a slip of 2.8 per cent at full load and of 10 per cent of the full-load speed at 175 per cent overload. Or, converting both slips to per cent of synchronous speed, we have:

Load	Slip in % Syn. Speed.
100%	2.8
275%	12.5

This shows that at the higher load the motor is operating on that part of its torque-speed characteristic which is not an approximately straight line.

Near the bottom of page 661 it is stated that the motor recovers about 90 per cent of its speed. Does this mean 90 per cent of its friction-load speed or 90 per cent of its drop in speed? Further, it is not explained what effect this lack of total recovery will have upon the system in subsequent cycles.

It would seem to the writer that the proper method of attack upon this problem would be as follows:

Construct a curve showing the available energy stored in the rotating elements over the speed range through which the operation is to take place. Any speed drop would cause a loss in this energy of rotation and the time in which the loss takes place gives a measure of the power given up by the system.

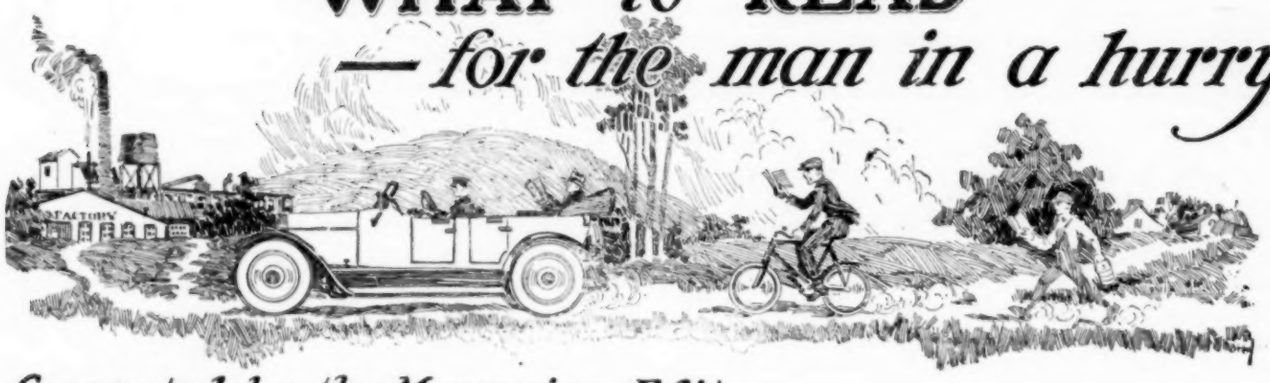
From the speed-torque characteristic of the motor may be determined the additional power drawn from the motor due to a speed drop. The combination of these two curves will give a relation between the total power used and the drop in speed required to produce it.

By using sufficiently small time increments, a third curve may be computed and plotted, showing the change in speed necessary to produce the desired power during the given time range.

The recovery may be computed even more simply. The motor is now delivering more power than required for friction. All excess over friction is stored in the flywheel with the result that it is accelerated. At the same time the available excess power of the motor is gradually being reduced, due to a gain in speed. This part of the problem is comparable to the computation in hydraulics of the discharge of liquid under a falling head.

This is a very interesting subject. The writer has been prompted to this criticism of Captain Varela's article in the hope that some of the points may be made more clear, and to call particular attention to the necessity of considering the torque-speed characteristic of the motor, as well as the power requirements of the driven machine, in computations of this nature.

WHAT *to* READ
—*for the man in a hurry*



Suggested by the Managing Editor

THANKSGIVING is a time for prayer as well as feasting and we couldn't resist the temptation of preaching a short editorial sermon on one of the serious business evils of today. The make-up man has placed it on the page opposite this one, and we sincerely hope you will real it carefully and take to heart the message it carries based on the text, "Give a square deal—and demand one." The last part of that text may not be good scripture but it is a great help in persuading the other fellow to observe the first part.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots

A new machine-tool description has the position of honor this week, the big sectional planer built by Sellers for shipbuilding work. The lubrication and and control features are a little out of the ordinary and will repay your time in investigating them.

On page 977 is the second of Professor Bonis' articles on the determination of accelerations. Last week's contribution covered the calculations for the flyweight of a wheel governor, a subject not very near to the heart of the machine tool designer, but this time we have the author's methods applied to what he calls the quadric chain and what is really the basis of the Whitworth quick-return motion as used on many of our shapers.

For those interested in railroads and railroad shops we have, beginning on page 982, a description of the new shops of the state Railways of Chile at San Bernardo. Apparently the days of the llama, the mule and the burro as the principal means of transport are numbered, for the shops covered are up-to-date in every respect and quite sufficient to care for the rolling stock of a modern railway. The fact that all the machinery and electrical equipment was supplied by American firms adds importance to the installation from our point of view.

Frank Stanley has some notes on several of the press tools used in producing parts for caterpillar tractors in a California shop, on pages 987 and 988. They were designed to produce a finished part in one operation, thus doing away with preliminary drilling.

The common ground on which theory and practice can most easily meet is that of common sense. The importance of this homely virtue in the science of engineering cannot be overestimated. Its effect on the work of some of our great inventors is discussed at some length by Walter M. McFarland, of the Babcock & Wilcox Co., on page 989. He says in conclusion, "Common sense is not a special gift and does not replace careful study, but it does mean the application to the problem at hand of your best experience and judgment without prepossession or prejudice."

A somewhat novel story begins on page 995. Sheldon went to Pittsburgh a while back to get some material for serious articles and while there got acquainted with some of the river boatmen and repair men. He tells of some of the things he saw and heard in a shop that was doing business a decade before the Civil War.

Fred Colvin has more automotive data from the Franklin shop, beginning on page 1001. This time he describes the machining of the cast aluminum transmission case.

On page 1004 and 1005 we are reprinting an account of a co-operative workmen's organization in Poland which is being financed by Polish-American mechanics. The company is operating two factories in Poland, the methods adopted being those learned in America.

Mr. Chubb's letter on business conditions in England appears on page 1016. Among the more important points mentioned are the terms of the coal strike settlement and the losses occasioned by the strike; the British Automobile Show; the loss of a big British mill equipment order to the German A. E. G.; and the serious condition of the aircraft industry. If misery loves company our airplane builders should be glad to hear of the hard times that have overtaken their British contemporaries. Along this line we have an editorial on page 1008 to which we call your attention.

Editorial mention is also made of the work being done by the Committee on Plain Limit Gages for General Engineering Work of the American Society of Mechanical Engineers. Classifications for various kinds of working fits have been proposed and it is desired to get as wide an expression of opinion thereon as possible.

Thanksgiving—
A Time for Serious Thinking and Resolve

THANKSGIVING DAY is a typically American holiday. Underlying the spirit of feasting and good cheer that fills the land, is a more solemn disposition to look back over the past year and to count its blessings and its disappointments. But what man can reflect on the past without thought of the future?

We Americans are too little given to introspection and serious thinking. We live in a young country and really have not a very long past to think about compared to other nations. Events at any time on this side of the Atlantic move with breathless speed but since 1914 they have outdistanced even the best of us and left us somewhat dazed and in need of a chance to pause and consider.

In the rush of war preparation the usual safeguards surrounding business dealings were cast aside and the door was opened to all sorts of graft, profiteering and dishonest practices. Under normal conditions they would never have had a chance to get in, but once the attention of the country was fixed on the world struggle we had the disgusting spectacle of men who had had the reputation of being good Americans forgetting everything but personal gain and throwing moral standards to the winds.

The Shipping Board investigation and the work of the Lockwood Committee in New York are uncovering much of the badness in two separate fields and it is to be hoped that some few of the offenders will be brought to justice. Things are not as they should be in the coal industry. We can find reasons for such evils in the abnormal circumstances surrounding war preparation and its immediate aftermath.

There is no such excuse for the deplorable lowering of the high business moral standards of a few years back. We used to boast that American business was the cleanest in the world and that the American business man kept his given word as his bond. But can each of us make such a claim today?

The cancellation of honestly made contracts for the sale of goods is undoubtedly justified in some cases by the business policy of making certain sacrifices to avert a financial crash but there are too many cancellations that savor far more of expediency than they do of real necessity. Such an attitude on the part of business men, big or little, is not far removed from that of the late Imperial German government toward solemn treaties, and constitutes a very grave menace to the carefully built structure of business confidence.

On another page we print a word of warning as to the effect of the prevailing contempt of contracts on some of our foreign-trade connections. With the home market stagnant and the barrier of adverse foreign exchange facing us we can ill afford to endanger our chances for foreign trade still further by shady dealings of any sort. There is no doubt whatever that we are going to need a foreign outlet for the products of our mills and factories in the very near future and need it badly.

IT IS not a pleasant picture, this immediate business past of ours, and does not seem to offer a great deal to be thankful for except that it *is* past. It remains, therefore, for us to look to the future and to see to it that our bright prospects are not darkened by the shadow which now hangs over us. The future holds much for America if she has the wit to grasp it. No other nation is as sound financially, no other nation has the large and varied resources, no other nation has the skilled producing organization. For the immediate present we have a bumper crop, a real merchant marine, a banking system that works and a change, politically, from an administration that has been satisfactory to no one in its handling of our affairs, to one that bids fair to accomplish some of the many things we always hope to have an administration do.

But we never will get very far until we are able to restore the confidence in each other that has been so lacking. We must preach and teach and practice a new morality in business and in industry that will carry conviction not only to our associates here but to our friends in foreign lands. The Golden Rule works just as well now as it ever did and it says nothing about waiting for the other fellow to make a start in doing the right thing. It puts it right up to each man to play fair. When he does so he has a right to expect the same treatment from others and he is much more likely to get it.

Let this Thanksgiving be a turning point in American business life. Let each man of us deal squarely with his employees, his customers and his competitors, and he can then go a step farther and reach the second part of our slogan—

Give a Square Deal—and Demand One

SHOP EQUIPMENT NEWS

-Edited By-
S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

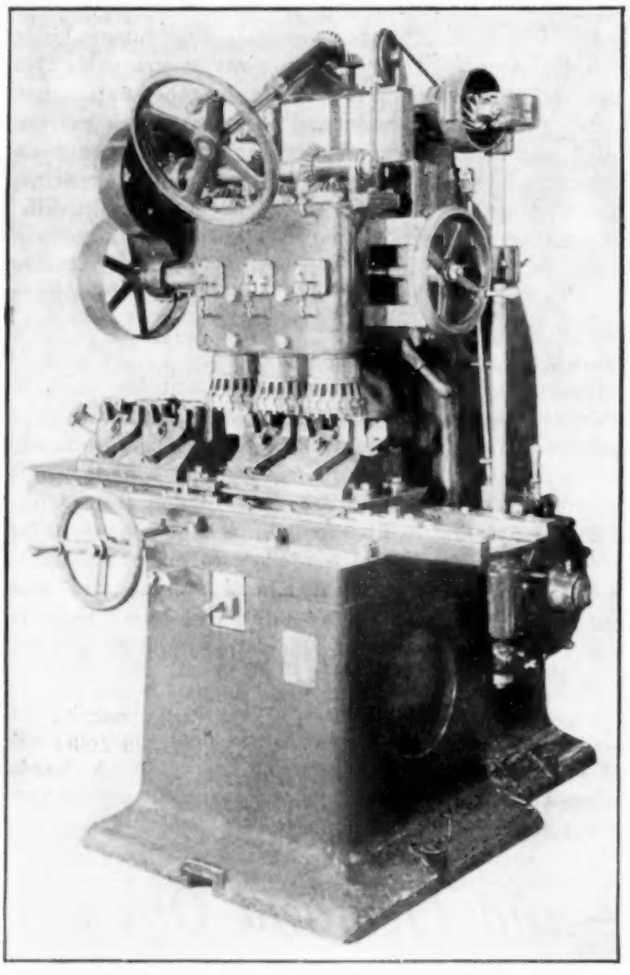
• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

The Coulter Automatic Multiple-Spindle Profiling and Milling Machine

A recent modification of the Coulter automatic multiple-spindle profile milling machine has been brought out by the Automatic Machine Co., of Bridgeport, Conn. The machine has been equipped with a transfer table designed to permit the use of double or reciprocating fixtures so that a milling operation may be carried on with practical continuity by having one portion of the fixture in position for unloading and reloading while the cutters are at work upon pieces held in the other portion.

While this machine is essentially for single-purpose production it is adaptable to a wide range of work by reason of the adjustability of the spindle positions and the varied arrangements of the cams possible to suit the class of work under consideration.

Details of the original machine were published on page 1322, Vol. 52, of *American Machinist*.



COULTER AUTOMATIC MULTIPLE-SPINDLE PROFILE MILLING MACHINE

Sheffield Solid and Adjustable Snap Gages

The Sheffield Machine and Tool Co., Dayton, Ohio, has brought out the snap gages illustrated. In Fig. 1 is shown the solid, two-sided go and not-go length snap gage. The end-blocks, including anvils and anvil holders, are made up as units and are then assembled to strip-steel beams thus making it possible to secure any desired length. The cylindrical snap gage shown in Fig. 2 is assembled from unit end-blocks and castings in a series of sizes from ¼ in. upward. Anvils are either adjustable or renewable, and both external and internal gages can be furnished.

Advantages claimed for these gages are that the anvils are easily and cheaply replaced and that when a gage size becomes obsolete it is necessary to throw away only the beam, the end-blocks and pins being saved to use in making another gage.

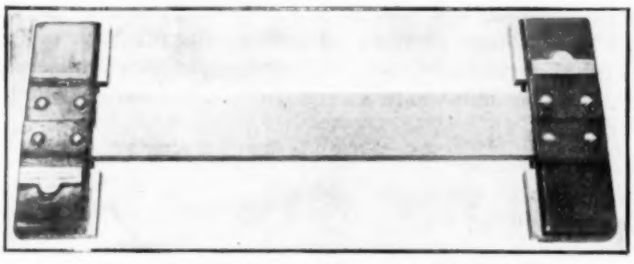


FIG. 1. SOLID GO AND NOT-GO SNAP GAGE

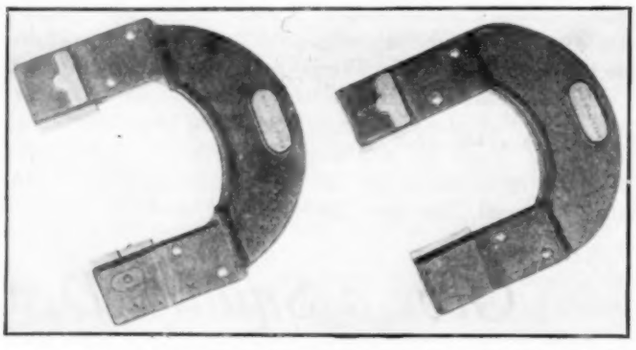
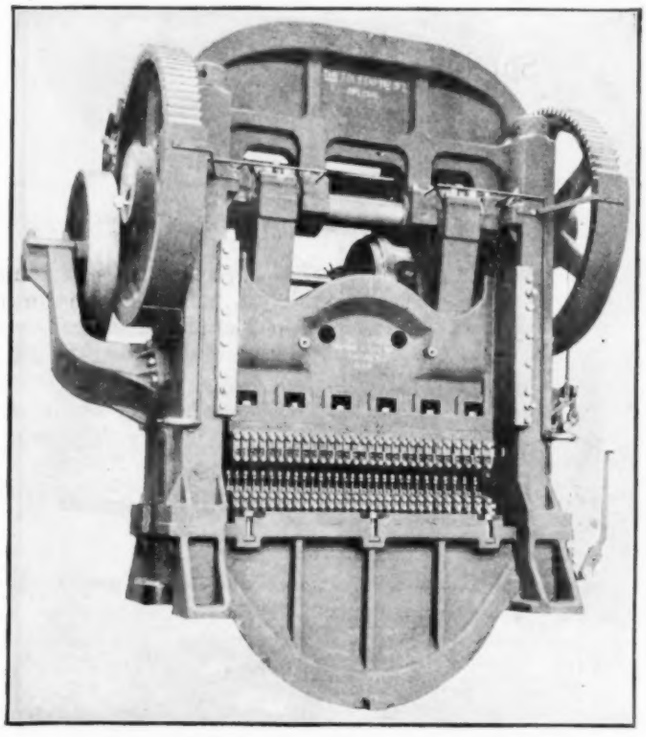


FIG. 2. CYLINDRICAL SNAP GAGES, ADJUSTABLE (LEFT) AND SOLID (RIGHT)

Toledo Multiple Punch Press

The accompanying illustration shows a large multiple punch press that has recently been built by the Toledo Machine and Tool Co., Toledo, Ohio. The press is of the double-crank type with twin-gear drive. As shown, it is fitted with sixty independently adjustable punches and dies for punching holes with varying distances between the centers. The punch holders are fitted with gags, so that by pulling out or pushing in the gags, holes may be punched or omitted as desired. The press is capable of punching 15 one-inch holes through $\frac{1}{2}$-in. steel.

The press is entirely self-contained and requires no outboard bearing, thereby reducing the floor space. It is controlled by a friction clutch having a positive stop, which automatically throws the clutch out at the top center. By changing the position of a small counterweight, the press can be run continuously, or else intermittently by operating the hand lever. The press is driven by a 30-hp. motor, which is supported on a bracket on the rear of the left-hand upright. It has a centralized forced-feed lubricating system, which permits the operator to lubricate all of the main bearings from the floor.



TOLEDO MULTIPLE PUNCH PRESS

The size of the press is shown by the following dimensions: Weight, about 165,000 lb. Width between uprights, 103 in. Area of bed, 36 x 102 in. Opening in bed, 4 x 98 in. Area of slide, 22 x 94 in. Diameter of crankpin, $13\frac{1}{2}$ in. Distance from bed to slide raised, 33 in.

"Electric" Arc-Welding Machine for Small Work

A hand-portable welding machine weighing approximately 100 lb. has been developed by the Electric Arc Cutting and Welding Co., 152-58 Jelliff Ave., Newark, N. J. The illustration shows a man holding the machine under one arm. The device is intended for light work, such as in a garage machine shop, and it can use electrodes from $\frac{1}{16}$ to $\frac{5}{32}$ in. in diameter. When using the smaller sizes of electrodes it can be operated continuously, but with the larger sizes the operation must be intermittent. Thus heavy work, such as on boilers or engines, can be done when necessity demands it; but the machine is intended especially for light welding, sheet-metal work, brazing, lead burning and the like. Building up worn parts can also be done.

SMALL PORTABLE ELECTRIC ARC-WELDING MACHINE

It is possible to operate the machine from a lamp socket on light loads, but it is intended that the supply wires of the device be attached to the panel board feeding the lights, provided that a current of 5 kva. is available. The machine will operate on any voltage between 90 and 130 and between 180 and 260. This is accomplished by the use of two coils, which can be placed either in multiple or series, and by providing means of regulation. The standard frequency is 60, but machines can be furnished for any frequency desired. It is said that there are no moving parts, so that troubles in the mechanism are not apt to occur.

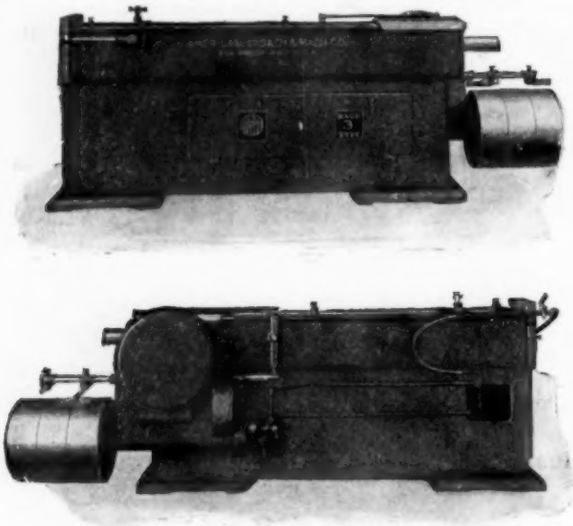
American Rack-Type Broaching Machine

The American Broach and Machine Co., Ann Arbor, Mich., has recently placed on the market a rack-type broaching machine in two sizes, Nos. $1\frac{1}{2}$ and 3, the difference being in the length of stroke and pulling capacity. The No. 3 machine is here illustrated, views of both the front and back being shown. The No. $1\frac{1}{2}$ machine is intended to handle broaches up to 40 in. in length, while the No. 3 can use broaches 58 in. long.

The drive is by belt, the speed reduction being made by means of an inclosed steel worm and phosphor-bronze worm-gear on the rear of the machine. The worm is hardened and provided with two roller thrust bearings to take up the end thrust. A hardened pinion on the shaft of the worm-gear drives the rack to which the broaches are attached by means of the sliding head. The section of the rack is D-shaped, the flat side with the teeth being on the bottom.

The reversal of motion of the rack is accomplished by shifting the belt at the ends of the stroke, the length of which can be adjusted by means of stops provided for that purpose. The return speed of the

rack is twice the cutting speed. A brake is automatically applied at the ends of the stroke, so as to absorb the momentum of the moving parts and to enable the travel of the sliding head to be accurately controlled. It is stated that there is no tendency to cause a twisting action in the starting head, such as occurs with a screw-type drive.



FRONT AND REAR VIEWS OF THE NO. 3 AMERICAN RACK-TYPE BROACHING MACHINE

Specifications: Maximum capacity: length of broach, 58 in.; will square or spline hole, 3½ in.; will cut keyways, 1¾ in. Height to center of bore, 32¾ in. Face, 15 x 14½ in. Bore, 5-in. diameter. Weight, crated with countershaft, 4,300 lb.

The base of the machine is of the cabinet type, and is fitted with shelves for holding broaches. One end of the base is finished and provided with T-slots, so that special fixtures or an oil trough can be attached. An oil pump, served from a trough in the base, is provided.

Grinding Attachment for Lathe

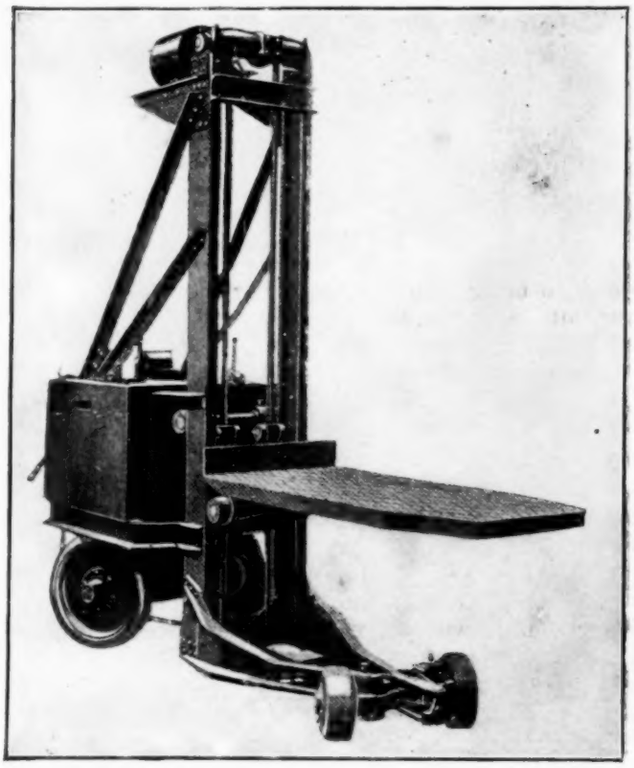
A portable grinding attachment for a lathe is manufactured by the Société pour l'Industrie Mécanique, Basel, Switzerland, which organization is represented in this country by François Chappuis, Room 2632, 120 Broadway, New York City. It is intended for internal and external cylindrical grinding. Either motor drive, as shown in the illustration, or countershaft drive can be used; the former is preferable, owing to its ability to operate in any position desired.

A SWISS GRINDING ATTACHMENT FOR LATHE USE

A high degree of precision is claimed for the machine. The spindle runs in three sets of ball bearings, mounted in an eccentric case, so that the height of the spindle can be regulated. Since the speed of the machine is from 12,000 to 18,000 revolutions per minute, a belt-tightening device is used. A small pulley and a splinter guard are furnished with the machine.

Lakewood No. 703-A Tier-Lift Truck

The Lakewood Engineering Co., Cleveland, Ohio, has added to its line of electrically-operated Tier-Lift trucks the one shown in the illustration and designated as Model 703-A. The general characteristics of the machine are similar to those of the Model 703 truck described in the *American Machinist* on page 52, vol. 52.



LAKEWOOD MODEL 703-A TIER-LIFT TRUCK

Both models are built in four sizes with lifts of 42, 60, 76 and 96 in., respectively. The difference is that the Model 703-A machine has an elevating speed nearly twice as great as the other machine, its maximum load being 2,000 lb., while that of the 703 truck is 4,000. The new model is intended especially for the handling of rather light, bulky packages.

Ross "Two-Way" Centrifugal Pump

The Ross Manufacturing Co., 3160 West 106th St., Cleveland, O., has placed upon the market a coolant pump that can be run in either direction. The liquid is delivered from the same orifice no matter in which direction the impeller is rotated, and reversal of the

direction of rotation, as on a screw machine, does not hinder the action.

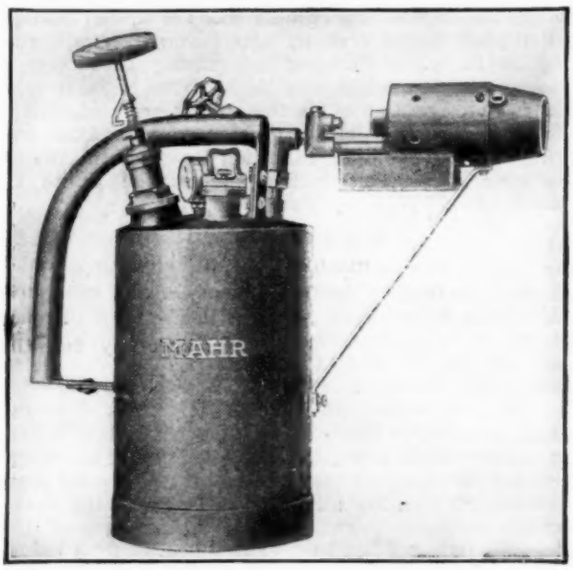
As can be seen in the illustration, the pump is belt-driven, the pulley having an internal gear on its rim. This gear drives a gear on the impeller shaft, the

ROSS "TWO-WAY" CENTRIFUGAL COOLANT PUMP

speed ratio being 1 to 4. An oil-less bearing is used; a graphite asbestos packing keeps the liquid from reaching the bearing or the gears. The four-bladed impeller is made of spring steel. It is claimed that, because the inlet is at the top, the impeller is always submerged and consequently primed. The pump delivers a large volume of coolant and can be used to serve a battery of small machines, by running it at high speed. It can also operate with a slight suction lift.

Mahr Style "T" Kerosene Torch

A self-contained kerosene torch, shown in the illustration and known as Style "T," has recently been placed on the market by the Mahr Manufacturing Co., Minneapolis, Minn. It is intended for use in foundries, tin shops, machine shops, or wherever a small heating appliance is required.



MAHR STYLE "T" KEROSENE TORCH

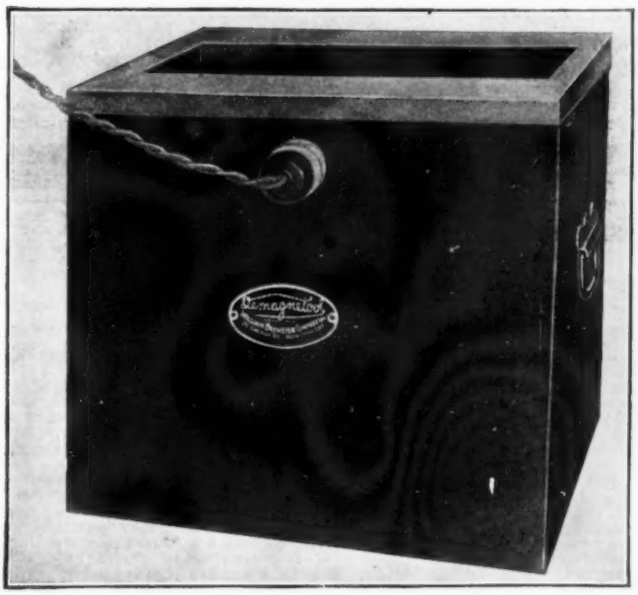
It is stated that the torch operates under a wide range of pressure, so that a few strokes of the pump will provide sufficient pressure to last for an hour. The entire head is made of brass, the high heat-conductivity of which is said to make for ease in generating and for steady operation. Starting the torch requires about 4 minutes. The gas plug screws down against a copper gasket, pipe threads not being used, thus insuring the proper distance between the plug and the nozzle. It is said that the flame cannot blow out, because the gases issue from the jet at very high velocity.

A cleaning tool is provided to remove carbon which might clog the torch.

The torch is made in three sizes, ½, 1 and 1½ gal., the oil consumptions being, respectively, 1, 2 and 3 quarts per hour. The net weights are 6½, 8½ and 10½ lb.; the boxed weights, 12½, 15½ and 18½ lb.; and the volumes when boxed are 1, 1.5 and 2 cu.ft. respectively.

Brewster "Demagnetool" No. 2

A type of demagnetizer suitable for production work, and with which it is not necessary either to rub or to place the work on the plate of the device, has been



BREWSTER "DEMAGNETOOL" NO. 2

placed upon the market by the William Brewster Co., Inc., 30 Church St., New York City. As shown in the illustration, there is an opening extending vertically through the demagnetizer, which is made in box form. It is only necessary to drop or pour the work through the opening in order to demagnetize it.

It is claimed that, due to the design of the transformer, the magnetic flux crosses at right angles the opening through which the work is passed, so that the action extends equally to all points of the working space.

The No. 2 "Demagnetool" has an opening 6 x 12 in., but other sizes of the machine can be furnished, if desired.

Business Conditions in England

By OUR LONDON CORRESPONDENT

LONDON, Nov. 5, 1920.

ALTHOUGH the miners rejected the terms of settlement reached between the government and the executive of the miners' federation it is expected that in a few days all the mines will be working. Votes cast for the terms numbered 338,045, and votes against totaled 346,504. As two-thirds of the members taking part in the voting did not vote in favor of the continuation of the strike it was declared off, but only after a considerable discussion and then simply by a "substantial majority" of the delegates assembled to consider the figures. The two districts that really voted against the proposal were the Lancashire, where the majority was 55,509, and South Wales, where the majority against was 46,405. Nearly all the other districts voted for acceptance of the terms.

WHAT THE TERMS ARE

These terms provide for the co-operation of the mine owners and workers to obtain increased output. For this purpose district committees and a national committee are to be organized. Further, the parties are to prepare a scheme, to be ready not later than by Mar. 31 next, for the regulation of wages in the coal mining industry "having regard, among other considerations, to the profits of the industry and principles upon which any surplus profits are to be dealt with." Until then wages are to be regulated on the following plan, without prejudice to the decision of the wages board:

(a) An advance of 2s. a shift to persons of 18 years of age and over; 1s. to persons of 16 and 17, and 9d. to persons under 16; will be paid from the date of resumption of work to the classes of colliery workers entitled to Sankey wage and subject to the conditions under which Sankey wage is payable.

(b) For the purposes of this temporary arrangement the advance referred to shall be automatically adjusted on the basis set out below from Jan. 3, 1921, in the light of the results of the five weeks ending Dec. 18, 1920, and similarly from Jan. 31 and thereafter every four weeks on the results of the four weeks immediately following the last preceding test period — but the Christmas holiday week shall not be counted in any such period, and an adjustment will be made in those cases where the holiday period falls wholly or partly within the New Year week.

The basis on which the advance shall be adjusted is as follows: If the weekly average of the proceeds of export coal during the test period are maintained at the weekly average of the proceeds of export coal during the September quarter the advance will be 1s., 6d., and 4½d. respectively. If (after deduction of the cost of extra output) they exceed the September figure an additional 6d., 3d., and 2¼d. respectively will be paid for every complete £288,000 of the excess.

(c) For this purpose the amount of export coal in each period shall be assumed to be the excess of the tonnage produced over the rate of 219,000,000 tons annually; the proceeds shall be calculated by multiplying that excess tonnage by the average f.o.b. price as shown in the Trade and Navigation Accounts for the quarter ended Sept. 30, 1920, and the cost of extra output shall be taken as 15s. a ton for each ton produced in excess of the rate of output for the quarter ended Sept. 30, 1920.

(d) As part of the settlement hereby concluded the government undertakes to make an order under section (3) of the mining industry act which will provide for the variation of the one-tenth share of the excess profits of the industry payable to the owners under the coal mines (emergency) act by the deduction therefrom or addition thereto of one-quarter of the said tenth part for each 6d. by which the men's advance is reduced or increased.

(e) The certificate of the secretary for mines as to the amount of the proceeds and the advances payable shall be accepted as final.

EXPORT PROFITS THE DECIDING FACTOR

Thus until Jan. 3 next the miners will receive an advance of 2s. a shift. After the date mentioned the sum of 2s. may be added to or diminished according to the output, export profits being the deciding factor. For the purpose of regulation both home consumption and export prices are apparently to be assumed as constant, so that the actual advance will depend on the putput as measured at yearly rates: Thus with the total output at the rate of 244,000,000 tons per annum the advance will be 3s. But this scheme of course is to operate only until the national wages board for the industry goes into operation. This board is regarded by many of the leaders as the first step toward public ownership of some sort of the mines. On the other hand the working miners are more concerned with the wages they will receive, and recognize that these will, at least to some extent, necessarily vary with the actual output, a position they definitely rejected when voting on the datum line proposals. The general disposition is to regard the terms accepted as purely of a temporary character. It seems probable that the whole problem will be raised when the wage board meets, for that body will apparently have to devise permanent means of settling wage rates; a matter about which, disregarding large views on the subject, there are many differences of practice throughout the country. The output committees to be immediately selected may perhaps help to clear the course for consideration of the larger problem, as employer and employed will have to work together for the time being for mutual advantage, and this may lead to a greater measure of co-operation later.

LOSS RESULTING FROM STRIKE

As to the loss entailed, measured in output of coal this is something like 15,000,000 tons. About £15,000,000 has been lost in wages, and some £2,000,000 in strike pay. The estimate has been made that in all two and one-fourth million workpeople were idle as the result of the strike.

Official figures for 1920 show that the coal output for the first quarter of the year was 62,103,000 tons with an average of 1,188,500 persons employed; for the second quarter, 58,166,000 tons with 1,200,300 persons; and for the third quarter, 59,467,000 tons with 1,207,800 persons.

THE MACHINE TOOL MARKET

In the machine-tool world orders have undoubtedly been scarce, and some small tools, for instance, twist drills, are drugs. Optimists are under the impression that as soon as the coal-strike dislocation has been put right trade will revive; but the troubles are probably deeper-rooted than that. During the last few days rumors relating to motor car firms have been less frequent. For one thing the motor show opens today and with it of course there is at least the hope that firms who have doubts will be able to resolve them as the result of exhibiting. Not that an exhibition is an infallible remedy, for one of the smaller firms that made a really serious effort at the recent machine-tool exhibition has had to close down within the past few days.

The technical journals during the war entered into a self-denying ordinance, not altogether voluntary in character, to omit all advertisements of German products. Various periods were suggested. But it is now being thought that the British manufacturer has had almost sufficient time to put his house in order and it is possible that by the beginning of next year German advertisements will be accepted. Then, competing frankly with the annual anachronism, the Lord Mayor's show, advertising men will run a procession in which "famous advertising characters and trade-mark figures will march through the main streets of London," and, again to quote their announcement, this will be "one of the big 'stunts' which will capture public imagination and compel attention to the International Advertising Exhibition" being held at the White City, Shepherd's Bush, W., from Nov. 29 to Dec. 4.

THE MOTOR SHOW

The motor show is, on account of the large number of exhibitors (about 500), being held in two halls widely separated, namely, Olympia, W., and the White City, Shepherd's Bush, W., and the price of admission permits a visit to both shows and also provides for motor-coach service between the two halls. No German cars are shown, but the exhibits include French, Italian, Swiss and Belgian, not of course to mention American. The French firms have made a special effort; having decided that the Paris automobile salon should be dropped for this year they are, according to some reports, regretting the decision already. It is suggested that the cars from overseas are rather cheaper than those of British make. The industry has been expecting a general reduction in prices, the position being exactly the opposite of that prevailing at the same time last year when premiums were

demanded for cars with immediate possession. But it is not thought that a very marked general decline in price will show itself until next year is well advanced, if then. Everything will depend on the demand, that of course varying to no small extent with the general condition of trade. British firms seem to be dropping their ladylike practice of introducing fashions at the show, and are making changes or improvements as and when they are needed or are advisable. A new eight-cylinder car has been introduced, the cylinders being in line. Once more attempts have been made to popularize hydraulic and electro-magnetic methods of transmission and regulation of speed.

The Austin Motor Co. has recently equipped a new foundry to cast about 60 tons of steel a week on one shift only, and has installed also a press plant for producing some 500 bodies a week. The tractor side has been extended; according to program, early next year the weekly output in this section will be about 200.

Export-Credit Scheme Modified

The government has modified its scheme of export credits, and the percentage of the cost of the goods to be advanced to the exporter may be increased to 100; previously it was 80 per cent. But there will be recourse against the exporter as regards 20 per cent. Some exporters have been claiming that, while the whole 100 per cent of the cost should be advanced to the exporter, no claim should be made in the case of default, his risk being simply that of his profits. Whether the 100 per cent advance shall be granted is to be decided by the export credits department of the Board of Trade.

The Airplane Industry

The enormous expansion of the aircraft industry during the war, particularly toward its end, naturally brought about a period of stress when military operations ceased and demand dropped. Several firms have been shut down and some have broken down. Now it is clear that the Aircraft Manufacturing Co., Ltd., is in difficulties and recently an informal meeting was held of various shareholders, etc. The accounts are not available, but it has been publicly stated that the results up to the end of March last will show a heavy loss and that the dozen or so subsidiary companies are also producing nothing in the way of profits. A bank overdraft has been accumulated amounting to £660,000 and a call has been made on the company to repay. Apparently therefore the assets are to be realized. According to proposals, the Daimler Motor Co., which is of course associated with the Birmingham Small Arms Co., will take a five years' lease of the factories at Hendon, with the option to purchase for four years. A debenture issue of £330,000 is proposed, in order to provide half the sum for which the Birmingham Small Arms Co. has made itself responsible in connection with the bank overdraft. The only alternative is a forced sale, which might not provide sufficient to pay off the overdraft. The estimated value of the factory and premises is put at £500,000 and other assets at £2,200,000; this is the book value, the realizable value being estimated at half that sum.

Germans Obtain Large British Order

The announcement that the A. E. G. of Berlin had secured a British order for electrical plant to the value of £150,000 had the effect of a bombshell on the electrical industry of Great Britain a week or so ago. The plant to be supplied is rolling-mill equipment for the Partington Steel and Iron Co., near Manchester. The German firm, which was asked to tender, submitted fixed prices; this course could not be followed by its British competitors. A turn of comedy has been given to the affair by the announcement that one of the directors of the firm concerned is president of a leading organization for the furtherance of British industries, and that another director is a public man well known for his advocacy of tariff reform (British royalty) protection.

A New System of Measurement

Messrs. Brooks and Sears, two officials of the National Physical Laboratory, Teddington, have devised a new system for producing slip gages of the well-known form and, it is claimed, a new system of measurement by which they can plot the contour of the gages to limits of considerably less than 0.000001 in. Stabilization of the steel employed has also received attention; it is something that has been overlooked by certain people, at any rate in Great Britain, who have attempted the production of these gages. The new gages are stated to be actually generated, all sizes being referred back from a standard foot that is an extremely accurate division of the standard yard. The blocks are not polished but are straight grained on the surface, polishing, as is well-known, producing a hard outer skin which is under stress and therefore tending to change the size and form of the gage. The hardness is 100 Shore. The set comprises 81 pieces, ranging from 0.1001 in. to 4 in. These gages are being made by Pitters Ventilating and Engineering Co., Ltd., London, S. E., and are being distributed by Alfred Herbert, Ltd., Coventry.

The High Cost of Metric Measurements

By W. Burr Bennett
President, Wayne Engineering Co.

Near us is a knitting mill making sweaters and other wool knit goods. It was established several years ago and it is possible that nothing but German made machines built to metric measurements could be obtained at that time. At any rate they have continued to buy similar machines, except during the late war. While we are not a tool shop or jobbing shop, nevertheless they often call on us to make repairs and parts in which case we endeavor to serve them. The writer has continuously suggested, however, that as far as posible, all new parts and repairs be made to standard English measurements in order to keep the cost down and to insure quick service. It so happens, however, that the sweater factory management is not in favor of this and we are compelled to work to metric sizes. Recently we had an example which shows the absurdity of conflicting the metric system with our own and which convinced us that we do not want any metric machinery.

Four small hardened-steel pawls were wanted in our shop; they weighed about two ounces each and contained two drilled and reamed holes and two tapped holes. To make up the four, using all metric measurements, cost $100. This of course included the making of one of the taps and the purchasing of the other, as well as the full use of metric measurements with which our toolroom was not over-familiar.

As an experiment, the writer made up a piece to serve the purpose employing all British or U. S. Standard dimensions, including taps and even making the necessary standard screws to fit the U. S. Standard thread. The piece worked perfectly and the total cost of one was about $10, or $60 less for four than it cost to make them in metric sizes.

The less we have to do with the metric system the better. If European and South American countries want U. S. goods let them take them with good old U. S. measurements.

Smoothing Up a Defective Thread By Means of a Castellated Nut

By C. Nye

Many times a planer bolt or similar piece gets a jam in the threads that makes it a source of annoyance. If a set of dies does not happen to be available, put the bolt in a vise, invert a hardened castellated nut and screw it down on the thread with a wrench. The castellated nut, being harder than the bolt, serves as a cutter and the slots afford a recess for metal cuttings.

SPARKS FROM THE WOR

Valentine Francis

Machine-Shop and Design Sections of A. S. M. E. Meeting

The machine-shop session at the annual meeting of the A. S. M. E. in New York, Dec. 7-10, 1920, will be given over to the presentation of three papers.

Earle Buckingham of the Pratt & Whitney Co. will present the results of a mathematical investigation on the side-cutting action of a hob when milling threads. The paper will deal with both externally and internally threaded parts and will indicate the corrections that can be applied to the form of hob to prepare a correct thread.

The paper by W. H. Chapman of the Norton Grinding Co. records the new developments in grinding practice in the present year and points out the importance of these developments.

Joseph F. Keller, general manager of the Keller Mechanical Engraving Co., will present a slide lecture giving important information concerning a new die sinking mechanism which he developed.

It is anticipated that this newly formed professional section session on machine shop will be a rallying point for machine-shop men throughout the country and that future intensive action in machine-shop development will be the result from this meeting.

Design Sessions

Data of great interest to designers of machines will be recorded in the papers to be presented before the design sessions.

Louis Illmer, oil-engine expert, Southwark Foundry and Machine Co., in his paper entitled, "Disastrous Experiences with Large Center Crankshafts," will point out the essential principles to be followed in the design of this type of shaft. Mr. Illmer's conclusions were obtained after a careful analysis of a failure of a large center crankshaft.

In his paper, "Tests on Rear-Axle Worm Drives for Trucks," K. Heindlhofer, research engineer of the SKF Industries, has tabulated data on the efficiency of motor-truck drives and will give information on the tests to destruction of several worms.

N. W. Akimoff, manufacturer of balancing machinery in Philadelphia, who has developed a successful balancing machine, will present an entirely new point of view on the design of foundations for machinery. Mr. Akimoff's device relates to the reduction of vibration by a study of the gyroscopic laws. It is believed that the principles he has evolved will be of particular value to the designer of high-speed rotating machinery on land and shipboard.

Acquiescing to the demand of hoisting-drum manufacturers, Professor E. O. Waters of Sheffield Scientific School, Yale University, worked out the formula for the rational design of hoisting drums. Professor Waters will present the results of his investigation and study to the meeting.

The designer of flywheels for reciprocating machinery connected to generators and motors will have at his disposal accurate information as to the methods to be followed and results to be attained in the design of this important adjunct of constant-speed mechanism. Messrs. Doherty and Franklin of the General Electric Co. will show in their paper wherein the procedure of design can be bettered and give principles to be used.

A Research Information Bureau

The National Research Council has established a research information service as a general clearing-house and informational bureau for scientific and industrial research. This "service" on request supplies information concerning research problems, progress, laboratories, equipment, methods, publications, personnel, funds, etc.

Ordinarily inquiries are answered without charge. When this is impossible because of unusual difficulty in securing information, the inquirer is notified and supplied with an estimate of cost.

Much of the information assembled by this bureau is published promptly in the "Bulletin" or the "Reprint and Circular Series" of the National Research Council, but the purpose is to maintain complete up-to-date files in the general office of the Council.

Requests for information should be addressed, Research Information Service, National Research Council, 1701 Massachusetts Avenue, Washington, D. C.

Welding Patents Association

At a meeting of the Welding Patents Investigating Committee, composed of nearly 500 members, held at the Hollenden Hotel, Cleveland, Nov. 9, it was decided to form a permanent organization which will be known as the Welding Patents Association. The committee was originally formed in 1917 to conduct litigation testing the validity of patents on the process of spot welding. Henry C. Milligan, president of the Republic Stamping and Enameling Co., Canton, Ohio, who has been chairman of the committee, was elected as chairman of the association.

Cancellations—Legal Liabilities of Buyer and Seller

In these days when cancellations of orders are so frequent, a word regarding the legal liabilities of the buyer and seller may prove of value.

It should be understood first that a contract comes into existence when an offer to buy is made by one party and accepted by the other and that such a contract is not subject to revision or cancellation, except by mutual consent. A legally enforceable obligation to pay arises when the buyer orders a quantity of goods shipped and the seller either promises to ship them or actually ships them upon receipt of the order. The law does not impose an obligation upon the buyer to receive goods which he has purchased, but if the buyer elects to refuse to carry out his part of the bargain he must pay to the seller whatever damages the seller has sustained.

But let us suppose that the buyer orders a quantity of goods which are to be specially manufactured for him, and thereafter, while the goods are in the process of manufacture, notifies the seller that he repudiates the contract and will not accept the goods, the law thereupon places upon the seller the duty of refraining from taking any further steps which would increase the amount of damages for which the buyer has made himself liable. The seller cannot continue to manufacture if to do so will pile up damages against the buyer.

Where goods have been specially manufactured for the buyer and are not suitable for sale to any one else, the seller may hold the buyer for the full value of the manufactured articles. But if the goods are suitable for sale to another and can be disposed of, the amount of damages which the seller can collect is limited by the amount of loss which he has sustained after disposing of the goods at their fair market value at the time the contract was to have been performed.

Attention has been called to a situation arising from loose business methods resulting in a state of facts somewhat as follows: A salesman takes an order from a buyer, using the seller's form of order blank. This blank, duly signed by the buyer, is forwarded to the seller's office and the order accepted and the buyer notified. Thereafter the buyer comfirms the order, using his own order blank, which sets forth terms differing from those contained in the original order. Subsequently the goods are shipped. What are the rights and liabilities of the parties? The answer is clear that the original order,

LD'S INDUSTRIAL FORGE
News Editor

having been accepted, is not subject to variation by the action of the buyer in forwarding his own confirmation. The seller has a right to insist upon the enforcement of the contract in accordance with its original terms; but if the confirmation differs so materially from the original order that it amounts to a repudiation thereof, the seller is clearly put upon notice that the buyer elects not to accept the goods on the terms originally agreed upon, and while the seller may still insist upon the performance of the contract under its original terms, he is nevertheless bound to refrain from taking any steps which will increase the damages to be paid by the buyer. Under such circumstances the only safe course for the seller to pursue is to notify immediately the buyer that the contract must be fulfilled as originally made or not at all, and that the terms of the confirmation are not acceptable, and that the seller will hold the buyer liable for breach of contract. —By W. Randolph Montgomery, Counsel, National Association of Credit Men, in the *Supply Manufacturer*.

W. R. Moore Gives Lecture on Grinding

A lecture on grinding, illustrated by stereopticon views, was the feature of the November meeting of the New York chapter of the American Society for Steel Treating. The lecture was given by W. R. Moore, sales engineer of the Norton Co., Worcester, Mass., and was held at the Machinery Club, Hudson Terminal Building, New York.

The meeting was preceded by a dinner at the club, after which the lecture was given, the diners retaining their seats. Mr. Moore commenced with a brief history of grinding, then going through the evolution of abrasive wheels from the mines to the finished products. Practically every type of grinding machine was illustrated, those made by concerns other than the Norton Co. being included.

A discussion on grinding followed, during which Mr. Moore satisfactorily answered all questions put to him

Thanksgiving Dinner at the Chicago Machinery Club

One of the annual customs of the Machinery Club of Chicago is the turkey dinner and general jollification held on Thanksgiving Day. This will be held again this year and not only will dinner be served for the price of $2.50 per couple, but cold lunch in the evening is included. The plans also include a musical program for the afternoon with music and dancing.

National Founders' Association Holds Annual Convention

Opening its twenty-fourth annual convention in the Hotel Astor, New York City, on Wednesday, Nov. 17, with a powerful speech by President William H. Barr, the National Founders' Association wrote another chapter into the history of the fight for the "open-shop" method of employment. All through the two days of the convention this issue was paramount and nearly every one of the speakers touched on some particular phase of the subject.

Mr. Barr has long been identified with this movemeent for the open shop and he covered the matter thoroughly. He stated that the opposition of the American Federation of Labor to the open-shop movement is evidenced by the plan of that organization to raise a huge sum to be spent in combating this growing menace to its control of the American workingman.

The speaker also touched on the labor clause as contained in Article 13 of the Covenant of the League of Nations. He had the following to say on this subject:

> During the campaign you heard much about the League of Nations, and various articles contained in the Covenant. But I refer to it only for the purpose of discussing Article 13, which creates an international labor office and which, if the Treaty were ratified, would put labor in the United States under its control. The first meeting of this annual international labor conference was held in Washington in October, 1919, at which the United States could not officially participate. But should the League of Nationals, or some similar agreement, ever become effective there must be not merely a reservation as to the international labor clauses, but their complete elimination. This existing labor office is largely dominated by its radical members, and the American Federation of Labor is cordially co-operating with these socialists in trying to entangle our country in the labor meshes of the League of Nations. For I emphasize the fact that there are in the proposed Covenant certain labor clauses which were apparently included at the request of our labor unions, and with the consent of our representatives, for the purpose of hindering our industries.

Mr. Barr is also associated with the Inter-Racial Council of New York and spoke as follows on the immigration problem as affecting our industrial life:

> This country needs immigrants, and will continue to need them. It is the industrial university of the world, and it requires a freshman class every year. The question is, whether we are to admit and distribute our immigrants according to a well-thought out consistent plan, or whether we are to continue to leave things to the mercies of chance and to politicians.
>
> We ought also to recognize a few fundamental facts on immigration. The immigrant comes here for his benefit, and we take him here for ours. If we accept him, we cannot at the same time exploit him or make him the universal goat when anything goes wrong. There are radicals who are foreign born, and most of them are misguided. There are, too, Americans of the same stripe, and they have less excuse. The very great majority of our immigrants are decent, law-abiding, intelligent, respectable, worthy people, and they will become good and enthusiastic citizens if given a square deal. In the fundamental things men and women are much the same the world over.
>
> It is time, therefore, that these problems of admission, distribution, assimilation and stabilization should be taken out of the hands of sentimentalists and politicians, and that they should be placed where they belong, in the hands of intelligent, impartial thinkers who know enough of American history to realize that we need these people for our own development and that, on the other hand, they need the wisdom and sympathy of unprejudiced Americans.

Emery on "Mistaken Philosophy"

James A. Emery, counsel of the National Industrial Council, and only recently chosen chief counsel for the National Founders' Association, spoke on the "Progress of the Open Shop."

Few men are better qualified to discuss this subject than is Mr. Emery. As a student of industrial problems and a lawyer of no mean talent, he has given much thought to this "mistaken philosophy"—as he termed the doctrine of the closed shop.

Mr. Emery started off by showing the evils of the closed shop and declared there was too little public appreciation of the influence of organized labor on production. He said that the idea of organization for legitimate benefit was ancient, but that it had grown in the wrong direction till now it was "an alien movement in our midst which threatened to undermine our economic structure and destroy the peace of society."

He declared that during the eighteen months in which the United States was engaged in the great war over 6,000 strikes in essential industries were participated in by union labor, with the resulting loss of time and money, besides the inconvenience to the public and those in conduct of our military establishment, and general confusion in the industrial life of the country.

In conclusion Mr. Emery said: "The growth of the open-shop movement is a natural consequence of the rising of the communities to a greater sense of justice, and a combined effort to throw back this false doctrine which is detrimental to its life.

"The defeat of the candidates, sponsored by the labor leaders in the recent election, shows the feeling of the public against this altogether mistaken philosophy. And so long as the American Federation of Labor sponsors that philosophy it cannot be a force for good in this country."

Colonel T. C. Dickson, commanding officer of the Watertown Arsenal, Watertown, Mass., took up the subject of "Industrial Relations in Arsenals of the Ordnance Department, United States Army." Of course, being an army officer, he was not at liberty to

say very much, but he intimated that it was time the public, and particularly the manufacturers of the country, looked into the growth of labor unionism in government circles.

In driving home this point Colonel Dickson quoted many War Department orders and other official documents to show the influence which labor officials must have at Washington.

C. C. Pettijohn, of New York, a pioneer in the movement of stamping out radicalism by means of the moving picture, was heard in an interesting talk on "Americanization on the Screen." Mr. Pettijohn accompanied his remarks with several reels of film, picturing the ways in which soveitism is spread among the ignorant and ill-informed.

THE OPEN SHOP IN TEXAS

On Thursday W. S. Mosher, of Dallas, Texas, presented a paper on "The Open-Shop Movement in the Southwest." Mr. Mosher traced the events, mostly strikes and labor troubles, which led to the formation of open-shop associations at Dallas and other industrial centers of Texas. He said the movement had the support of the public and the merchants and was a booming success, but was ever on its guard against the bitter opposition of labor unions.

A particularly noteworthy phase of this address was the suggestion offered by the speaker to the employers, to "sell their company to the employees." He urged a policy of better working conditions, consideration and constructive management as a means of bringing the employees into closer co-operation and thus establishing a bulwark against the ever present danger of radicalism.

Other papers presented at the convention were: "The Relationship of the Stock Exchange to Industry," by J. Edward Meeker, of New York, and "Modern Foundry Equipment," by Joseph J. Wilson, of the General Motors Corporation, Saginaw, Mich.

The convention discussed and unanimously passed a resolution congratulating the United States Chamber of Commerce in its stand against the closed shop in this country.

BARR RE-ELECTED

At the conclusion of this part of the program the election of officers took place. William H. Barr was unanimously re-elected president, and he carried all the other officers in with him.

The others elected were Julius Goslin, of Birmingham, Ala., vice-president; Arthur E. McClintock, Chicago, Ill., commissioner; Jeffrey M. Taylor, Chicago, Ill., secretary.

Society Changes Headquarters

The American Society for Steel Treating has changed its headquarters to 4600 Prospect Ave., Cleveland, Ohio. This change was made on Nov. 20 and all future correspondence should be mailed to the new address.

A Record for Freight Traffic

The highest recorded volume of freight traffic ever transported in the history of the Pennsylvania Railroad System was handled during the month of October. Reports from all divisions, which have just reached the general offices in Philadelphia, show that during the month an average of nearly 24,000 loaded cars per day, or 167,461 per week, were forwarded to their respective destinations. This represents more than 870,000 tons of freight a day, or over 6,000,000 tons a week, loaded on the Pennsylvania Railroad, or accepted by it from connecting lines.

The nearest approach to the figures for October of this year were those of the corresponding month of 1919, when the daily average of loaded cars handled was 23,700. As compared with midsummer, the freight traffic handled has been increased by an average of 3,300 cars per day, or approximately 120,000 tons.

New Publications

Advertising the Technical Product. By Clifford Alexander Sloan and David James Mooney. 365 pp., 6 x 9, illustrated. Published by McGraw-Hill Book Co., Inc., 239 West 39th St., New York City.

A real advertising manual for the man with a technical product to sell, manufacturer, advertising manager or copy writer. The subject is well presented and there are ideas for every man connected with the advertising business. The book is divided into five parts as follows: I, The General Problem and Its Economic Elements II, The Instruments Available for Advertising the Technical Product; III, Technical Advertisements; IV, Advertising Organizations; V, Appendix.

One of the most interesting features of the book is the section of the appendix in which sample advertisements taken from various sources are criticized by the purchasing engineer, the sales manager, the advertising manager and the sales engineer. There is also a good bibliography in the appendix.

Material for the book has been contributed by the following well-known men in the industry. J. C. McQuiston, manager, Westinghouse Department of Publicity; Robert Porter, vice-president, Jaxon-Steel Products Co.; F. M. Feiker, vice-president, McGraw-Hill Co., Inc.; J. A. Harlan, purchasing agent, Delco-Light Co.; M. F. Lawrence, sales promotion manager, Hyatt Roller Bearing Co.; P. C. Gunion, advertising manager, Industrial Division, General Motors Corp.; O. W. Crawshaw, president, Crawshaw Service; S. Sidney Neu; E. E. Eby, American director, Delco-Remy, Ltd., T. P. Cunningham, vice-president, Lincoln Products Corp.; D. L. Darnell, assistant sales manager, Baker Industrial Truck Co.; C. A Trapper, president International Trade Press Association; F. D. Wood, advertising department, *Good Housekeeping;* R. Bigelow Lockwood, manager, Advertising Service Department, McGraw-Hill Co., Inc., Jesse H. Neal, executive secretary, Associated Business Papers; J. Frank Eddy, The Dando Co.; J. D. McGuire, president, McGuire Printing Co.

Export Register of the Federation of British Industries. Three hundred and twelve 7 x 9¼-in. pages including advertisements and indexes. Published for the federation by the Industrial Publishing Service, Ltd., 4-7 Red Lion Court, London, E. C. 4.

The book is divided into the following sections, with cross references: Products; Companies, Firms and Their Agents; Associations, Arranged in industrial groups; Advertisements. In the section on Companies, Firms and Their Agents, which is a list of the members of the federation, each member's name is followed by the name of his overseas agents.

Business Items

The corporate name of the Dawson-Rouillard Tool Corporation has been changed to the Dawson Tool Corporation. The address of the company is 51st St. and Lancaster Ave., Philadelphia, Pa.

The board of directors of the T. H. Symington Co., manufacturer of railway specialties and special machinery at Lincoln Park, at a meeting in New York City on Oct. 27, elected Donald S. Barrows, heretofore works manager and chief engineer, as vice-president in charge of operations.

The Chicago offices of the Tacony Steel Co., Philadelphia, have been removed from the Marquette Building and are now situated at 427 Reaper Block. F. B. Hillwick, former district sales representative in this district, has been succeeded by A. H. Ackerman.

The Lafayette Tool and Equipment Co., Lafayette, Ind., manufacturer of universal grinding machines, has appointed Russell, Holbrook & Henderson, Inc., with sales offices at 30 Church St., New York and 548 Leader News Building, Cleveland, Ohio, its sole United States representative.

The Baltimore Tool Corporation, 921 Sterrett St., Baltimore, Md., has been recently incorporated. Charles A. Schmidt, secretary and treasurer, says that the company expects to have one of the best equipped tool manufacturing plants in the East, in conjunction with which blacksmith, forging and machine work and commercial heat treating will be solicited.

The Bowers & Bartlett Co., Inc., Baltimore, Md., manufacturer of washing machines, has leased a building at 1201 South Sharp St. as a plant.

The Syracuse Washing Machine Corporation, Syracuse, N. Y., which now makes only laundry apparatus, plans to extend its field to include other labor-saving devices, such as ironing machines and dishwashers. G. C. Wilkinson, a vice president of the company, is to have charge of this development work.

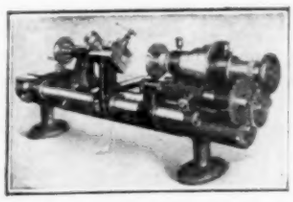
The Reed & Prince Manufacturing Co., Worcester, Mass., manufacturer of machine screws, etc., held a three days' salesmen's conference at its plant recently. It brought together twelve of its men from the principal distributing centers of the country and each day a set of speakers talked on various problems of interest relating to the work of the men in the field, etc.

The Hardware City Manufacturing Co., New Britain, Conn., has changed the name of the company to the Plainville Manufacturing Co., and has also removed the plant of the company from Elm and Seymour Sts., New Britain, to Plainville, Conn., where it has a modern equipped plant.

Condensed-Clipping Index of Equipment

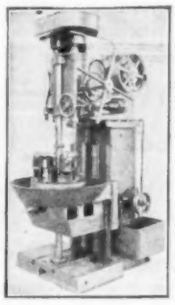
Patented Aug. 20, 1918

Attachment, Lathe, Bench, Thread-Chasing
S. A. Potter Tool and Machine Co., 77 East 130th St., New York.
"American Machinist," Oct. 28, 1920



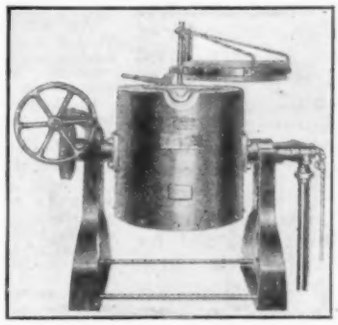
This fixture can be readily attached to the company's Nos. 5 and 7 lathes. It will cut threads up to 5 in. long with leads from 4 to 84 threads per inch. The lead screw is mounted on a shaft carried in brackets at the rear of the headstock, a short section of the screw being fluted to form a hob for cutting the bronze lead-nut when necessary. The tool-holder is mounted on a slide which is provided with screw adjustment and a graduated feed dial. The slide swings on a frame mounted on the chasing bar back of the bed.

Drilling Machine, Two-Spindle, No. 220
Baker Bros., Toledo, Ohio.
"American Machinist," Oct. 28, 1920



This machine is built as a single-purpose production tool for successive operations and can be used for drilling, boring, counterboring, reaming, facing, etc. The indexing table affords two work stations and a loading station. The rated capacity of the machine is 2-in. diameter for high-speed drilling. The spindle centers are 10½ in. apart. The length of downfeed is 12 in. Changes of spindle speed can be had by changing slip gears in the gear box on the side of the machine. Specifications: Speeds and feeds built to suit job. Weight, 5,200 lb. Floor space, belt drive, 31 x 42 in.; motor drive, 31 x 66 in. Motor, 10 to 15 hp. Height, 8½ ft.

Furnace, Tilting, Crucible Type, Oil-Burning, No. 3015
Wayne Oil Tank and Pump Co., Fort Wayne, Ind.
"American Machinist," Oct. 28, 1920

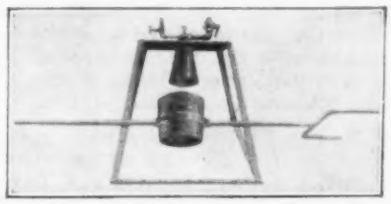


The furnace stands entirely above ground; is self-contained and is ready for connection to the oil and air supply lines. Specifications: Three sizes, Nos. 3, 6 and 9. Respective capacities, 200, 350 and 750 lb. Average heats per day, 6 to 10, 5 to 9, 3 to 5. Floor space, 36 x 66 in., 39 x 68 in., 42 x 70 in. Height to cover, 3 ft. 8 in., 3 ft. 10 in. and 4 ft. Air pipe connections, 2, 2½ and 3 in. Oil pipe connections, ¾ in. Air volume required, 200, 250 and 400 cu. ft. per minute. Shipping weights, complete, 2,000, 2,500 and 3,000 lb. The burner is designed for air at a pressure of from 1 to 2 lb. and oil at pressure of 5 lb. or more.

Bandsaw, Bench, "Junior"
West Side Iron Works, Grand Rapids, Mich.
"American Machinist," Oct. 28, 1920

This machine can be used as a portable machine or mounted on a bench when not furnished with the pedestal. It is furnished either for belt or motor drive. The belt drive pulley is 5½ x 1¼ in. The frame is a one-piece cored casting, carrying self-oiling bearings for the shafts. The wheels are 14 in. in diameter with 1 in. face and are covered with rubber bands. The shaft of the upper wheel runs in a double yoke-box and has a tilting device for shifting the saw-blade to the desired path. The table is 16½ x 19 in., is finish-planed and can be tilted to any angle up to 45 deg. The overall height without pedestal is 3 ft. 6 in.

Heater, Ladle, No. 3085
Wayne Oil Tank and Pump Co., Fort Wayne, Ind.
"American Machinist," Oct. 28, 1920

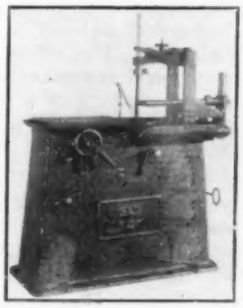


This heater is for use in connection with tilting crucible and non-crucible melting furnaces. It consists of a frame upon which the ladle may be supported at various heights. There is mounted on the top plate of the frame, an inverted burner with a cone-shaped hood to blow the flame into the ladle. The burner is designed for connection to the regular oil or gas supply lines and uses oil at 5 lb. or more pressure and air at 1¼ lb.

Welding Machine, Electric, A.-C., "Weldrite"
Electric Welding Machine Co., 500 East Larned St., Detroit, Mich.
"American Machinist," Oct. 28, 1920

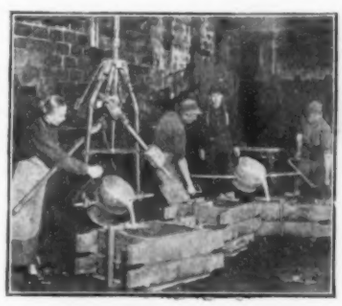
The company recommends this device for welding cast-iron and repair work. The device uses a short drawn arc, eliminating the necessity of preheating. It is built without moving parts and is so designed that the delivery of voltage and amperage to the work remains substantially constant. The machines are built to be operated on 110-, 220- or 440-volt alternating-current, indoors or out, where access can be had to an electric circuit of 75 amp. capacity. They are portable, the largest type weighing about 300 lb. All are mounted on ball-bearing casters.

Slotting Machine, No. 25
Racine Tool and Machine Co., Racine, Wis.
"American Machinist," Oct. 28, 1920



The base contains the main working parts of the mechanism and the reservoir for the coolant. The table has a slotted hole lengthwise through its center for about one-half its length which permits the table to be fed for that distance into the cutting tool. Specifications: Table, 12 x 27 in. Strokes per minute, 60. Length of stroke, 7 in. Drive pulley, 3 x 10 in. Pulley speed, 750 r.p.m. Net weight, 2,000 lb. Floor space, 26½ x 57 in. Height overall, 58 in. Power required, 2 hp. The machine is furnished either with tight and loose pulleys for belt-drive or with a tight pulley only for motor drive.

Pouring Device, Mechanical
E. J. Woodison Co., Detroit, Mich.
"American Machinist," Oct. 28, 1920



The illustration herewith shows the relative advantages of this pouring device over the old-style method. The pouring is said to be more accurate, with fewer spills and accidents. Adjustable levers and a counter-weight enable ladle capacities of over 400 lb. to be lifted 18 inches.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

LUTHER A. DAVIS, formerly production superintendent of the Standard Screw Co., Corry, Pa., and more recently with the Hydraulic Pressed Steel Co., Cleveland, Ohio, is now connected with the lamp equipment division of the National Lamp Works, General Electric Co., Cleveland, Ohio.

PETER H. GODA, who until recently was general foreman of the Lorain, Ashland & Co. R.R., Ashland, Ohio, is now with the Pennsylvania R.R., Pitcairn, Pa.

W. S. QUIGLEY, president of the Quigley Furnace Specialties Co., New York City, has just returned from Europe after an extensive trip made in connection with installations of the Quigley powdered-coal system in Italy and Belgium.

W. H. DEWOLFE has been appointed district manager of the New Britain Machine Co., with headquarters at 294 Washington St., Boston.

CLIFFORD F. MESSINGER has been appointed general sales manager of the Chain Belt Co., Milwaukee, to succeed L. C. Wilson who has resigned to become secretary of the Federal Malleable Co., closely associated with the Chain Belt Co. Other promotions announced are C. E. STONE, assistant to the vice president, and J. A. MONAHAN, purchasing agent.

C. C. BRADFORD has changed the name of the selling organization which he has recently formed, from the Manufacturers' Sales Co. to the Bradford Sales Co. The offices of this company, which will represent not more than two manufacturers as a district sales office of each, are located at 340 Leader-News Building, Cleveland, Ohio.

MISS GRETCHEN RASELY, for several years connected with the advertising department of the Norton Co., of Worcester, Mass., and later assistant editor of the *Norton Spirit*, the factory paper of the company, has resigned her position to accept one as editor of the shop paper of the Westinghouse Lamp company's plant in Bloomfield, N. J. Miss Rasely will be one of the few woman editors of such papers in the country.

JAMES E. MCKENNE, superintendent of the National Manufacturing Co. division of the Wickwire-Spencer Steel Corporation, at Worcester, Mass., has resigned his position. He has accepted a position in the production department of the Republic Rubber Co., Youngstown, Ohio.

ROBERT G. ASHMAN has resigned as superintendent of the Worcester Pressed Steel Co., Worcester, Mass., to become general manager of the J. D. Crosby Co., Pawtucket, R. I., manufacturer of cold-rolled strip steel, flat wire, etc.

E. KENT SWIFT, treasurer of the Whiton Machine Works, of Whitinsville, Mass., was recently chosen a member of the chief executive commission of the Associated Industries of Massachusetts.

CHARLES E. HILDRETH, president of the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., has been appointed receiver of the Standard Plunger Elevator Co., of Worcester, which was recently petitioned into bankruptcy by creditors of the company.

JOHN H. COLLIER, superintendent of the Bridgeport, Conn., plants of the Crane Co., of Chicago, has been elected as president of the Bridgeport Manufacturers' Association. Mr. Collier succeeds Clarence E. Bilton, who is the president of the Bilton Machine Tool Co., of Bridgeport.

CHARLES L. LANGLOTZ is now assistant manager of the export division of H. H. Robertson Co., New York. He was formerly assistant regional manager of the Allied Machinery Co. of America, New York.

Obituary

JOSEPH H. BAIRD, founder of the Baird Machine Co., Bridgeport, Conn., died on Nov. 14 in Cheshire, Conn. He was president of the above company until 1913, when, at his own request, he made way for a younger man; however, he acted in advisory capacity to the last. As an inventor Mr. Baird's reputation was world-wide. He was the first man in the United States to manufacture pins and invented many of the machines and methods used throughout the world in making them. He invented a pin-sticking machine which puts the pins into papers, and a safety-pin machine which takes a coil of wire and drops out complete pins ready for the cleaning or plating operation. Mr. Baird was the inventor of many automatic machines that are used for making every-day products in large quantity. One of his early inventions was the machine that fastened the hoops in hoop skirts. He sold this invention for thirty dollars and the man who bought it resold it for fifty thousand dollars. Mr. Baird was associated with many of the men who developed the manufacturing industries of New England and was generally recognized as a pioneer in the manufacturing of machines for the automatic making of small wares and notions.

A. J. BABCOCK, formerly president of Manning, Maxwell & Moore, Inc., New York, died in London, England, Oct. 30, after a short illness. Mr. Babcock was born in Brookfield, N. Y., in 1850. He served in the regular army during the Civil War, after which he studied a tool law course and practiced law in Denver, Colo., from 1882 to 1884. Mr. Babcock entered the machinery business in Chicago with Fay & Egan Co., and later was in the employ of Manning, Maxwell & Moore, Inc., as the Chicago branch manager. Seven years ago he came to New York as assistant to the president and finally was made president of the company, retiring in May, 1920, because of ill health.

SAMUEL H. WHEELER, of Bridgeport, Conn., prominent in several manufacturing plants of that city, died in Chicago on Nov. 14 after an illness of but two weeks. Mr. Wheeler, who was one of Connecticut's wealthiest citizens, was for a number of years president of the Wheeler & Wilson Manufacturing Co. of Bridgeport, which company was absorbed by the Singer Manufacturing Co. some years ago.

JOHN M. LYNCH, vice president of the American Hardware Co., Bridgeport, Conn., died very suddenly at his home on Sunday, Oct. 31. Mr. Lynch was at his office the day previous, and was apparently in the best of health. He was fifty-one years old, and had been in the hardware business in Bridgeport for the past thirty-two years.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An American engineer who is about to go to China desires to secure the representation of firms for the sale of machinery, tools, hardware, and technical and engineering lines. References. No. 33,991.

An engineering equipment company in Wales desires to purchase electrical accessories, such as conduit pipes, ceiling roses, cutouts, lamp holders, switches, and to secure an agency for the sale of mechanical latches, drilling machines, shaping, milling, and slotting machines, engineer's small tools, leather and balata belting, and iron and steel. Quotations should be given c.i.f. Welsh port. Reference. No. 34,013.

A mill owners' association in India desires to secure an agency and purchase rice-mill machinery, including steam engines, boilers, and crude-oil engines, horizontal and vertical boilers, electrical plants for bungalows and factories, agricultural machinery, etc. Quotations should be given c.i.f. Madras. Payment to be made against documents through bank in India. Reference. No. 33,994.

A producer and wholesaler of oxygen in Denmark desires to secure an agency and purchase oxygen-welding and cutting equipment for metals, all kinds of tools and apparatus for the ship-building industry, iron and steel, and automobiles. Reference. No. 33,994.

Forthcoming Meetings

The 1920 annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York City, from Dec. 7 to Dec. 10.

The American Institute of Weights and Measures will hold its annual meeting at 2.30 p.m. in the United Engineering Societies Building, 29 West 39th St., New York, Dec. 10, 1920.

The Society of Automotive Engineers will hold its annual meeting on Jan. 11 to 13 inclusive at New York.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drill, Portable, Electric, Type "C"

Arnold Electric Tool Co., Inc., New London, Conn., and 114 Liberty St., New York.

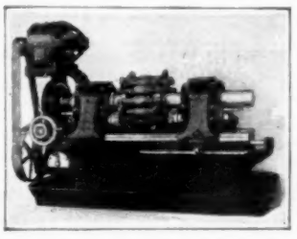
"American Machinist," Oct. 28, 1920

This drill has a ⅓-hp. motor and an idle speed of 480 r.p.m. It is claimed to have a capacity for drilling ¼ in. in steel and ⅜ in. in wood or brass. The motor operates on both a.c. and d.c. current of 110 to 120 volts, although machines can be furnished for other voltages. Each section of the tool can be removed as a unit. The breast-plate and the spade handle are interchangeable. The overall length of the tool is 16½ in., and the weight 13¼ lb.

Milling Machine, Four-Spindle, Continuous, Duplex, No. 1

Davis & Thompson Co., 251 Reed St., Milwaukee, Wis.

"American Machinist," Oct. 28, 1920



This machine is intended for continuous end milling and milling to length. In each head are two cutter spindles having an endwise micrometer adjustment of 2 in. and provision for locking them in place after adjustment. The right-hand head is adjustable on the bed, permitting milling various lengths up to the capacity of the machine. The work is held in a revolving fixture as shown and the cutters are so located that the front ones do the roughing and the back ones the finishing. The work mandrel is supported in both heads and is rotated by worm gearing. The various feeds are by change gears.

Screwdriving Machine, Automatic, Magazine-Feed

Reynolds Machine Co. Massillon, Ohio.

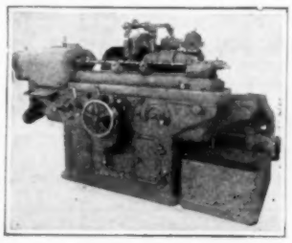
"American Machinist," Nov. 4, 1920

Not only screws of ordinary length but even those having a length shorter than the diameter of their heads can be driven by this machine. The screws are dumped at random into the magazine where they are automatically delivered, with heads upward, to an inclined track. At the lower end of the track a finger receives a screw and holds it in line with the spindle. The spindle, carrying a screwdriver bit, is brought down by a treadle.

Attachment, Cam-Grinding

Landis Tool Co. Waynesboro, Pa.

"American Machinist," Nov. 4, 1920



Intended for grinding cams for internal-combustion engines. The master cams are mounted directly on the work spindle inside the headstock. It is claimed that in generating master cams from models, the roller used is of the same diameter as the grinding wheel to be used for reproduction and that with this method, together with the pivotal position of the attachment, cams in duplicate of the models can be reproduced with the minimum of error. The live spindle is worm driven. The attachment can be furnished in the following sizes: 5½ x 26½ in., 5½ x 36 in. and 5½ x 52 inches.

Wood Trimmer, Revolving Knife

A. E. Bauer & Son, 7021 S. Racine Ave., Chicago, Ill.

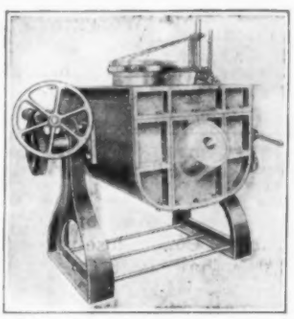
"American Machinist," Oct. 28, 1920

It is claimed that the revolving knife cuts instead of crushes off the wood, making a straight, smooth cut with a polished surface effect on any kind of wood. The total cutting edge of the knife is 16½ in. The guides at the ends can be set at any angle up to 45 deg. and 45, 60 and 90 deg. angles are marked on the base of the machine. There is an attachment to be used when grinding the knife. Specifications: Length overall, 17½ in. Width overall, 11 in. Height (without handle), 9 in. Maximum length of cut, 7½ in. Maximum height of cut, 2⅜ in. Diameter of knife, 5¼ in. Weight, 40 lb.

Furnace, Tilting, Non-Crucible Type, Oil-Burning

Wayne Oil Tank and Pump Co., Fort Wayne, Ind.

"American Machinist," Nov. 4, 1920

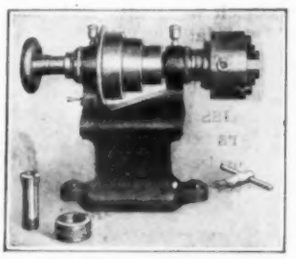


This type of furnace melts brass, copper, aluminum, etc. The furnace is charged through a 10-in. hole in the center of the top. The shell of the furnace is of ¼-in. steel plate with reinforcements of angle iron. The firebrick lining is 7 in. thick with a layer of insulating material between it and the furnace shell. Specifications—Built in two sizes, Nos. 3 and 6. Respective capacities, 350 to 550 and 550 to 800 lb. Average heats per day, 6 to 10 and 5 to 9. Floor space, 56 x 80 in., 66 x 80 in. Height to cover, 51 in. Pipe connections, air, 3 in.; oil, ¼ in. Air volume, 400 and 500 cu.ft. per minute at 1½-lb. pressure. Oil pressure, 5 lb. or more. Shipping weights complete, 5,500 lb. and 6,500 lb.

Headstock, Mounted for Bench Use

S. A. Potter Tool and Machine Works, 77 East 130th St., New York.

"American Machinist," Nov. 4, 1920

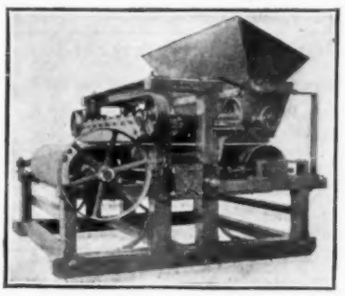


The device can be employed for filing, polishing and lapping, being adapted to performing speed-lathe work where no tailstock is required. The headstock is essentially the same as that used on the bench lathes made by the concern. It can be fitted with jaw chucks, spring chucks and lever chuck-openers. The device is driven by belt and fastened to the bench by means of two bolts.

Separator, Magnetic, Type "B"

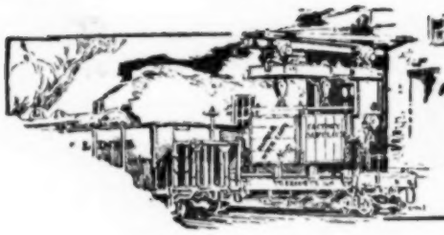
Dings Magnetic Separator Co., Milwaukee, Wis.

"American Machinist," Nov. 4, 1920



This machine extracts iron from brass, aluminum borings and turnings, abrasive materials, rubber buffings, etc. It has an electro-magnet with poles above two cross-belts which travel above a wide belt containing the materials to be separated. The materials are placed in the hopper from which they are distributed evenly on the wide belt. The cross-belts carry the particles which are raised by the magnetic poles to the side of the machine from which they drop into receptacles. These machines are built in five sizes, with conveyor belts from 18 to 60 in. in width.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$46.50	$30.35
Northern Basic	42.80	27.55
Southern Ohio No. 2	48.50	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	54.50	32.40
Southern No. 2 (Silicon 2.25 to 2.75)	49.16	35.20
BIRMINGHAM		
No. 2 Foundry	42.00	29.25
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	47.25	29.00-30.00
Virginia No. 2	47.00	33.10
Basic	46.50	26.75
Grey Forge	46.50	26.75
CHICAGO		
No. 2 Foundry local	47.00	26.75
No. 2 Foundry, Southern	48.67	28.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	47.56	28.15
Basic	43.96	27.15
Bessemer	50.96	29.35

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.15	$4.30	$3.47	$3.58	$3.37	$3.58	$3.47
Soft steel bars	4.15	4.50	3.37	3.48	3.27	3.48	3.37
Soft steel bar shapes	4.15	4.50	3.37	3.48	3.27	3.48	3.37
Soft steel bands	5.50	6.43	4.07	6.25	...	...	...
Plates, ¼ to 1 in. thick	4.15	4.75	3.67	3.78	3.57	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.77
Warehouse, New York	4.75	3.37
Warehouse, Cleveland	3.52	3.27
Warehouse, Chicago	4.12	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-5.80	6.15@7.25	4.57	6.25	6.13
No. 12	3.60-5.85	6.20@7.30	4.62	6.30	6.18
No. 14	3.65-5.90	6.25@7.35	4.67	6.35	6.23
No. 16	3.75-6.00	6.35@7.45	4.77	6.45	6.33
Black					
Nos. 18 and 20	4.20-5.85	7.90@8.80	5.30	7.55	6.90
Nos. 22 and 24	4.25-5.90	7.95@8.85	5.35	7.60	6.95
No. 26	4.30-5.95	8.50@8.90	5.40	7.65	7.00
No. 28	4.35-6.00	8.10@9.00	5.50	7.75	7.10
Galvanized					
No. 10	4.70-6.00	8.65@10.00	5.75	8.00	7.25
No. 12	4.80-6.10	8.75@10.00	5.85	*8.10	7.30
No. 14	4.80-6.10	8.75@10.10	5.85	8.10	7.45
Nos. 18 and 20	5.10-6.40	9.00@10.40	6.15	8.40	7.75
Nos. 22 and 24	5.25-6.55	9.15@10.55	6.30	8.55	8.15
No. 26	5.40-6.70	9.30@10.70	6.45	8.70	8.30
No. 28	5.70-7.00	9.60@11.00	6.75	9.00	8.60

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.15	$5.80	$5.50
Flats, square and hexagons, per 100 lb. base	6.65	6.30	6.00

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL — Base prices in cents per pound F. O. B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, grades "A" and "C" (base)	72
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods "D" — low manganese	64
Manganese nickel hot rolled (base) rods "D"— high manganese	67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: 3/16, 8½c. per lb.; ¼, 8c.; 5/16 to ½, 7½c Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	11.00	12.00
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	6.00	5.79	5.32
Cold-rolled strip steel	12.50	8.25	10.75
Floor plates	6.40	4.00	6.63

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	54–57½%	41½–44%	⅜	15½–25½%	+1½–11½%
			½	19½–29½%	1½–11½%
			¼ to 1¼	24½–34½%	8 –18½%

LAP WELD

2	47 –50½%	34½–38%	1¼	...	...
2½ to 6	50 –53½%	37½–41%	1½	...	...
7 to 12	47 –50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41%	...	4½ to 6	22½–30½%	9½–17½%
15	35 –38½%	...	2½ to 4	22½–30½%	9½–17½%
			7 to 12	19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

¼ to 1¼	52 –55½%	39½–43%	⅜ to 1¼	24½–34½%	9½–19½%
2 to 3	53 –56½%	40½–44%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45 –48½%	33½–37%	1¼	...	...
2½ to 4	48 –51½%	36½–40%	1½	...	...
4½ to 6	47 –50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43 –46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38 –41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	38%	22%	39%	30%	54%40%	40½@30 %
2½ to 6 in. steel lap welded	33%	18%	41%	26%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.75	18.50	22.50
Tin in 5-ton lots	38.75	44.50	56.50
Lead	7.25	8.50	6.25
Zinc	7.00	8.50	7.60
ST. LOUIS			
Lead	7.25	8.00	6.00
Zinc	6.75	7.70@8.05	7.15

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	23.50	29.50	33.50	26.50@29.00	35.50	36.00	36.50
Copper wire (carload lots)	20.00	20.00	30.75	24.00	30.50	29.00	26.00
Brass sheets	28.50	28.50	32.00	25.00	33.00	27.00	28.00
Brass pipe	28.00	33.00	36.00	30.00	39.00	34.00	37.00
Solder (half and half) (case lots)	31.00	35.00	45.00	29.00	41.00	38.00	38.50

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	24.00
New York	27.00	28.00@29.75
Cleveland	25.00	29.00
Chicago	30.00	27.00

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f.o.b. mill + less 8% for carload lots..... 11.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	12.50	14.70	13.00
New York	14.00	11.50	14.50	12.50
Chicago	14.50	16.50	14.95	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.25	9.50
Chicago	7.25	9.75
Cleveland	8.00	9.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.50	17.00	12.00	11.50
Copper, heavy, and wire	12.00	16.00	11.75	11.00
Copper, light, and bottoms	10.00	14.00	10.00	10.00
Lead, heavy	5.00	4.75	5.50	5.25
Lead, tea	4.00	3.75	3.75	4.00
Brass, heavy	7.00	10.50	8.00	11.25
Brass, light	5.50	7.50	5.00	6.00
No. 1 yellow brass turnings	7.00	10.00	6.00	6.00
Zinc	4.50	5.00	3.75	4.50

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	$33.00	$30.00	$33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	32.00
Chicago	29.00	31.00
Cleveland	27.00	35.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	70.00	90.00	47.00	70.00	45.00	60.00
Commercial	30.00	50.00	18.00	16.50	11.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from $16 to $20.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$1.25	$1.50	List net	$2.25	+1.15	1.85
Hot pressed hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.85
Cold punched hexagon	+ 1.25	1.50	List net	2.25	+1.15	1.30
Cold punched square	+ 1.25	1.50	List net	2.25	+1.15	1.30

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	40%	50%
Cleveland	50%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+'0%	30%	20%
Larger and longer up to 1½ in. by 30 in.	Net list	30%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... list Cleveland..... $2.50 Chicago..... $1.90

For cast-iron washers, ½ and larger, the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+ 20%	30%	20%
Larger and longer up to 1 in. by 30 in.	+ 20%	25%	15%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	20%	net	20%
New York	30%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	20%	40–5%	30%
Tinned	20%	40–5%	30%

Boiler, ½, ¾, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York..... $6.00 Chicago..... $5.73 Pittsburgh..... $4.5

Structural, same sizes:

New York..... $7.10 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	28.00	33.00	35.00
Brass	27.00	30.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add .15-20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $9.85 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	15.00@17.00	13.00	15.00	15.00@17.00
Colored mixed	9.00@14.00	9.00–12.00	11.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	3.00	2.50
Chicago	2.00	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.90	$3.65
Philadelphia	3.65	3.65	3.87
Chicago	4.10	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	November 22	November 15	November 8
Prompt furnace	$ 8.00@$10.00	$11.50@$12.00	$16.00@$16.50
Prompt foundry	10.00@ 12.00	12.50@ 13.00	17.00@ 18.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

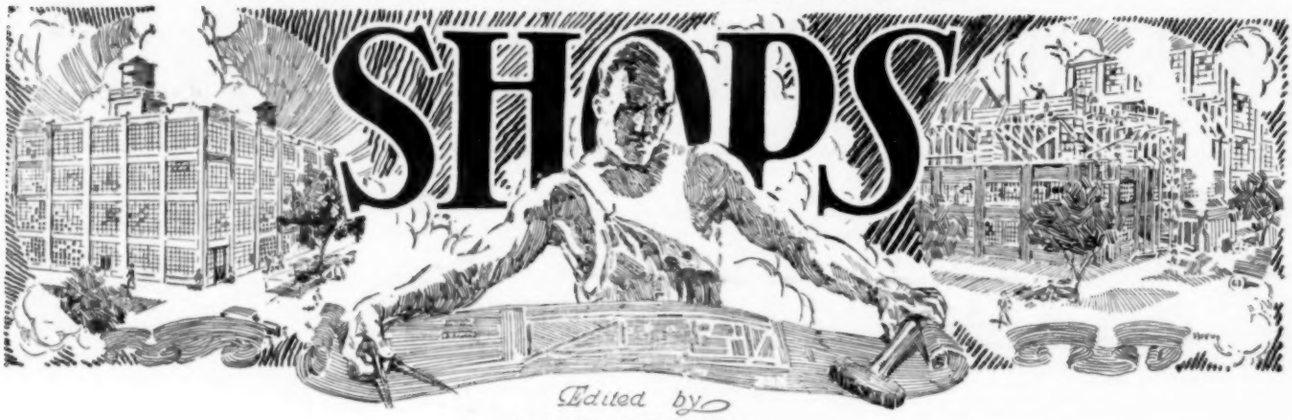
	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$1.00	$2.15	$1.25	$2.50	$1.08	$2.37
5-gal cans	1.15	2.30	1.50	2.75	1.33	2.57
1-gal cans (6 to case)	1.25	....	....	....	....	....

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	14.25	15.75	13.00	14.50	14.25	13.00
25 and 50-lb. kegs	14.50	16.00	13.25	14.75	14.50	13.25
12½-lb. keg	14.75	16.25	13.50	15.00	14.75	13.50
5-lb. cans	16.25	17.75	15.00	16.50	16.25	15.00
1-lb. cans	17.25	18.75	16.00	17.50	17.25	16.00

500 lb. lots less 1% discount. 2000 lb. lots less 10–20½% discount.

NEW *and* ENLARGED



Edited by
L·V·FLETCHER

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Shelton—The E. W. Iles Mfg. Co., Hull St., manufacturer of tools and gages—several turret lathes and other machine tools.

N. Y., New York (Borough of Manhattan)—The Copic Service Co., 473 Broome St.—one Universal press.

N. Y., New York (Borough of Manhattan)—Rojo, Fabian & Co., 350 Bway.—one 2½ ft. radial drill with 6 change speed box for motor drive, complete with tapping attachments, round table, swinging knee, etc.

N. Y., Rochester—The Alent Machine Tool Co., 419 St. Paul St., N. Alent, Purch. Agt.—general machine tools including special surface grinder.

N. Y., Rochester—L. Freedman, mechanical engr., c/o Selden Truck Corp., Probert St.—boring mill, drill press and arbor press.

N. Y., Rochester—B. Goetz, 110 Central Bldg., manufacturer of jewelry—metal rolling machine.

N. Y., Rochester—The Harrison Machine Co., 146 Platt St., machine builders and repairers, J. Harrison, Purch. Agt.—general machine tools.

N. Y., Rochester—The L. L. L. & D. Mfg. Co., 203 State St., manufacturer of reflectors for head lights, F. B. Shannahan, Purch. Agt.—broaching and brazing machines.

N. Y., Summerville (Rochester P. O.)—J. Pollock, Stop 24 (machinist)—Standard tapping machines.

Pa., Philadelphia—The Mueller Electric Co., 222 North 11th St.—engine lathes.

Pa., Philadelphia—The Precision & Thread Grinder Mfg. Co., 1932 Arch St., F. R. Imhoff, Mgr.—several surface grinders, similar to the Brown & Sharpe No. 2.

Ill., Chicago—The Atchison, Topeka & Santa Fe Ry. Co., Ry. Exch. Bldg., M. J. Collins, Purch. Agt.—

One 6 spindle nut tapper, capacity up to 2¼ in., belt drive.

One 4 spindle bolt turning machine, capacity up to 2¼ in., Easkester type, belt drive.

One 6 spindle turning and threading machine for crown and side staybolts, belt drive.

Two 20 in. x 7 ft. cabinet turret lathes for brass locomotive parts, similar to Manning Maxwell & Moore No. 1.

One No. 9 Niles, Bement & Ponds vertical milling machine, or similar; 230 volt, d.c. motor drive, alternate on No. 10 and No. 12.

One 100 in. heavy duty boring mill with 2 heads on cross rail and 4 chuck jaws, 230 volt, d.c. motor drive.

One 96 in. x 96 in. x 16 ft. heavy duty cylinder planer for locomotive cylinders with 2 heads on cross rail and 2 side heads, 230 volt, d.c. motor drive.

One double head slotter for locomotive frames, with bed 40 ft. long, 66 in. wide and with 24 in. stoker stroke; each head individually motor driven, 230 volt, d.c.

One 100 in. heavy duty tire boring mill for locomotive drive wheel tires, 230 volt, d.c. motor drive.

Two 24 in. heavy duty slotters with compound table and cross feed in 2 directions, belt drive or 230 volt, d.c. motor drive.

Four 24 in. x 12 ft. heavy duty engine lathes, 230 volt d.c. motor drive.

Four 6 ft. radial drills, 230 volt. d.c. motor drive.

One 8 ft. radial drill, 230 volt, d.c. motor drive.

Two 60 in. heavy duty vertical boring mills with 2 heads on cross rail, 230 volt, d.c. motor drive.

One 48 in. x 14 ft. heavy duty engine lathe, belt drive or 230 volt, d.c. motor drive.

One 30 in. stroke draw-out-shaping machine, Morton or equivalent, alternate on 32 or 36 in. stroke.

One 28 in. x 14 ft. double head shaping machine, belt drive or 230 volt, d.c. motor drive.

Ill., Chicago—Ellis Drier Co., 332 South La Salle St.—No. 3 plain miller, single pulley drive, double crank press with bolster plate about 15 x 60 in. equal to No. 206 Toledo, gap shear 60 in. blade to cut ¼ to ⅜ in. stock (used).

Ill., Quincy—The Wall Pump & Compressor Co.—radial drills.

Ind., Marion—The Marion Machine Fdry. & Supply Co.—one 1¼ in. hand screw machine; one 18 in. or 20 in. x 8 ft. bed lathe with backing off attachments, one 42 in. back geared engine lathe, with 30 in. over carriage, 12 ft. between centers.

Mich., Detroit—The Detroit Precision Tool Co., 521 Lincoln Ave.—miscellaneous machine tool equipment.

Mich., Detroit—R. E. German, Statler Hotel—lathes, shapers, milling machines, drill presses, planers, boring mills, turret lathes, gear cutters, grinders (used equipment in good condition).

Mich., Detroit—The Modern Die & Plate Press Mfg. Co., 122 Sherman St.—die making equipment.

Mich., Detroit—The Rund Sales Corp., 833 Woodward Ave.—garage equipment.

Mich., Mt. Clemens—The Sauzedde Mfg. Corp., Evans and Rose Sts.—equipment for the manufacture and enameling of wire wheels.

O., Columbus—The Tifft Martin Machine Co., 9 West Poplar Ave., R. W. Martin, Purch. Agt.—one milling machine No. 2, one French fly wheel press, and one 16 in. turret lathe (used).

O., Crrville—The Will Burt Co.—Attachments for Garvan screw machines.

Wis., Ft. Atkinson—The Bull Milking Machine Co., North Main St., L. Bull, Purch. Agt.—3 drill presses, sizes 14 in., 20 in. and 26 in.

Wis., Gleason—J. Houle—machinery for garage repair work.

Wis., Mineral Point—The Fiedler Motor Co.—garage repair machinery.

Wis., New London—The New London Machine Shops—Universal miller and Universal shaper.

Wis., Oshkosh—The Challoner Co., 29 Osceola St., manufacturer of saw mill machinery, etc.—one trimming press and one forming press.

Wis., Milwaukee—The Andrew Mfg. Co., 533 30th St., manufacturer of motors, W. Andrew, Purch. Agt.—one ½ in. to 3 in. internal grinder.

Wis., Ripon—E. J. Peschke—lathe and other equipment for garage repair work.

Ala., Birmingham—A. G. Glass, 1322 Glen Iris Ave.—sheet metal working and riveting machines for making ovens of sheet steel.

Machinery Wanted

N. Y., Rochester—The Bartholmay Brewing Co., 555 St. Paul St., S. B. Foster, Pres.—$100,000 worth of machinery for its crude oil refinery.

Pa., Philadelphia—The Amer. Ice Co., 6th and Arch Sts.—machinery for the manufacture of ice.

Mich., Battle Creek—The Bd. Educ., F. Harvey, Secy.—monorail crane.

Mich., Saginaw—The Bd. Educ.—shop equipment to include metal and woodworking machinery.

Wis., Fond du Lac—The Fond du Lac Paper Co., 298 Forest Ave—special paper machinery.

Wis., Jefferson—The Jefferson Rubber Co.—rubber working machinery.

Wis., Kewaunee—The Kewaunee Mfg. Co., manufacturer of laboratory furniture—woodworking machinery.

Wis., Milwaukee—The Hercules Knitting Co., 1097 Greenbush St.—special knitting machines, etc.

Wis., Milwaukee—The Blochowiak Dairy Co., 1364 4th Ave.—new creamery equipment for proposed plant at Helenville.

Mo., St. Louis—The T. J. Moss Tie Co., Security Bldg.—treating machinery for its proposed creosoting plant at East St. Louis, Ill.

Que., Montreal—The Royal Duke Refining Co., 157 St. James St.—$50,000 worth of equipment for its proposed plant in East Montreal.

Metal Working

NEW ENGLAND STATES

Conn., New Britain—Landers, Frary & Clark, Commercial St., manufacturers of hardware and cutlery, will build a 1 story, 50 x 150 ft. and 50 x 160 ft. additions to its plant, on East Main and Lake Sts. Estimated cost, $25,000.

Me., Auburn—The Darling Auto Co., 15 Turner St., will build a 1 story, 80 x 100 ft. garage, etc., on Franklin St. Estimated cost, $40,000. Noted Nov. 4.

Me., Augusta—Bunker & Savage, Augusta Trust Bldg., have awarded the contract for the construction of a 1 story, 50 x 106 ft. garage and service station on Main St. Estimated cost, $20,000.

Me., Augusta—P. M. Lawrence Co., 320 Water St., has awarded the contract for the construction of a 1 story garage on State St. Estimated cost, $25,000.

Mass., Everett—J. E. Sheppard, 198 Elm St., plans to build a 1 story, 50 x 50 ft. garage on Chelsea St. Estimated cost, $10,000. Private plans.

Mass., Gloucester—M. S. Katz, 46 Poplar St., will build a 1 story garage on Maplewood Ave. Estimated cost, $25,000.

Mass., Holyoke—The Worthington Pump & Mchy. Corp., 37 Appleton St., will remodel old schoolhouse on North Bridge and East Dwight Sts. into pattern shop building. Estimated cost, $30,000. Noted Nov. 11.

Mass., New Bedford—F. W. Greene, Jr., 252 Union St., is having plans prepared for the construction of a 1 story garage on Emerson St. Estimated cost, $25,000. La Brode & Bullard, 251 Union St., Archts.

Mass., Springfield—The Ridgewood Community Trust Co., c/o Kirkham & Parlett, Archts., 25 Harrison St., has awarded the contract for the construction of a 1 story, 40 x 60 x 70 ft. garage on Mulberry and Union Sts. Estimated cost, $15,000.

Mass., Worcester—The Morgan Constr. Co., 15 Belmont St., has awarded the contract for altering and building a 1 story, 50 x 50 ft. addition to its machine shop, on Crescent St. Estimated cost, $30,000.

MIDDLE ATLANTIC STATES

N. J., Newark—Cohen & Katchen, 201 Norfolk St., will build a 1 story, 50 x 100 ft. garage on Stanton St. and Sherman Ave. Estimated cost, $20,000.

N. Y., Glendale (Brooklyn P. O.)—The Eastern Eng. & Constr. Co., c/o Gilbert & Ashfield, Archts. and Engrs., 350 Fulton St., Brooklyn, has awarded the contract for the construction of a 1 story, 120 x 300 ft. pipe fitting shop. Estimated cost, $80,000.

N. Y., New York (Borough of Bronx)—A. L. Guidone, 52 Vanderbilt Ave., Manhattan, will build a 2 story, 50 x 100 ft. garage on Jerome Ave. and Bedford Park Blvd. Estimated cost, $85,000.

N. Y., New York (Borough of Bronx)—The Kissler Realty Co., Inc., c/o J. DeHart, Archt., 1041 Fox St., will build a 1 story, 100 x 110 ft. garage on East 167th St. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—B. Clayman, 37 Van Buren St., will build a 1 story, 100 x 150 ft. garage on De Kalb Ave. near Tompkins Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Manhattan)—G. H. Aspland, c/o DeRose & Cavalieri, Archts., 370 East 149th St., will build a 1 story, 50 x 210 ft. garage on Park Ave. and Gouverneur Pl. Estimated cost, $25,000.

N. Y., New York (Borough of Manhattan)—The Ferncliff Garage Inc., c/o DeRose & Cavalieri, Archts., 370 East 149th St., will build a 1 story, 121 x 123 ft. garage on 3d Ave. near Franklin St. Estimated cost, $75,000.

Pa., Coraopolis—The Keystone Garage Co. has plans prepared for the construction of a 1 story, 50 x 110 ft. garage. Estimated cost, $25,000. T. E. Cornelius, House Bldg., Pittsburgh, Archt.

Pa., Philadelphia—A. Pestcoe, 1625 South 6th St., has awarded the contract for the construction of a 2 story, 50 x 120 ft. garage, at 707 Tasker St. Estimated cost, $20,000. Noted Nov. 11.

Pa., Philadelphia—A. M. Russel, 1327 Dickinson St., has awarded the contract for the construction of a 2 story, 47 x 70 ft. addition to his garage at 1339 South Jupiter St. Estimated cost, $13,000.

SOUTHERN STATES

N. C., Raleigh—The State Highway Comn. plans to build mechanical equipment sheds and repair shop. Estimated cost, $75,000. W. S. Fallis, State Highway Engr.

W. Va., Huntington—The Fordlette Engine Co. plans to build a plant, which will probably include a foundry, machine shop and assembly plant. Estimated cost, $100,000.

MIDDLE WEST STATES

Ill., Chicago—M. Block & Son, 1123 Newberry Ave., will soon award the contract for the construction of a 3 story, 48 x 100 ft. sheet metal factory at 1120-25 Newberry Ave. Estimated cost, $50,000. Dubin & Eisenberg, 139 North Clark St., Archts.

Ill., Chicago—The Independent Packing Co., 41st and Halstead Sts., has awarded the contract for the construction of a 1 story, 75 x 125 ft. garage at 4119 Emerald Ave. Estimated cost, $50,000.

Ill., Chicago—The Joseph Bros. Lumber Co., 3393 Archer Ave., plans to build a 1 story, 75 x 150 ft. garage. Estimated cost, $50,000.

Ill., Chicago—The Oppenheimer Casing Co., 1020 West 36th St., has awarded the contract for the construction of a 1 story, 26 x 70 ft. garage and an 80 x 147 ft. factory, on West 38th St. and Auburn Ave. Estimated cost, $35,000.

Ill., Chicago—The Parmalee Transfer Co., 202 South Clark St., will soon award the contract for the construction of a 150 x 180 ft. garage on Monroe and Racine Aves. W. E. Perry, 64 East Van Buren St., Archt.

Ill., Chicago—The Union Stock Yards Casting Co., 834 West 49th Pl., is having plans prepared for the construction of a 1 and 2 story, 60 x 125 ft. foundry at 4843 South Morgan St. Estimated cost, $28,000. A. Ritter, 140 South Dearborn St., Archt.

Mich., Detroit—The Rund Sales Corp. has awarded the contract for the construction of a 1 story, 50 x 140 ft. garage at 833 Woodward Ave. Estimated cost, $20,000.

Mich., Kalamazoo—The Clarage Fan Co., North and Porter Sts., is building an addition to its foundry. F. M. Murdie, Supt.

Mich., Mt. Clemens—The Sauzedde Mfg. Corp., Evans and Rose Sts., is having plans prepared for the construction of a 2 story factory for the manufacture of auto parts and wire wheels. Estimated cost, $75,000. H. T. Millar, Lightner Bldg., Detroit, Archt.

O., Cleveland—The Beilstein Young Co., 7508 Carnegie Ave., has awarded the contract for the construction of a 1 story, 22 x 34 ft. garage at 1795 Crawford Rd. Estimated cost, $10,000.

O., Cleveland—The Belmore Co., Society for Savings Bldg., will soon award the contract for the construction of a 2 story, 75 x 150 ft. garage and commercial building at 731 Vincent St. Estimated cost, $50,000. A. Garfield, Natl. City Bldg., Archt.

O., Cleveland—The Hess Auto Body Co., 15008 Aspinwall Ave., will build a 1 story, 50 x 60 ft. workshop at East 152d St. and Aspinwall Ave. Estimated cost, $10,000.

O., Cleveland—C. J. Howley, 10305 Clifton Blvd., is building a 1 story, 65 x 150 ft. Garage at 11000 Clifton Blvd. Estimated cost, $25,000.

O., Cleveland—Teufel Bros., (packers,) c/o C. E. Tousley, Archt., 4500 Euclid Ave., had plans prepared for the construction of a 1 story, 40 x 130 ft. garage on West 65th St. Estimated cost, $40,000.

O., Conneaut—The Conneaut Telephone Co. has awarded the contract for the construction of a 2 story, 40 x 80 ft. telephone exchange building and garage. Estimated cost, $75,000. Noted Oct. 21.

O., Mt. Vernon—The C. and G. Cooper Co., 11 Bway., New York City, has awarded the contract for the construction of a 1 and 2 story foundry and machine shop, etc. Cost about $400,000.

O., Warren—Brier Hill Steel Co., Youngstown, has taken an option on a 480 acre site north of here, for the purpose of constructing a steel mill. Estimated cost, $1,500,000. E. L. Ford, Chn. of the Advisory Com.

Wis., Kaukauna—The Kaukauna Motor Service Co. had plans prepared for the construction of a 4 story, 50 x 100 ft. garage and show room on 3d and Main Sts. Estimated cost, $75,000. Juul & Smith, Imig Bldg., Sheboygan, Archts.

Wis., Kewaunee—The Kewaunee Mfg. Co. is having plans prepared for the construction of a 4 story, 24 x 102 ft. factory on Main St., for the manufacture of chemical laboratory furniture. Estimated cost, $50,000.

Wis., Oshkosh—R. Lutz, 1270 Knapp St., is having plans prepared for the construction of a 2 story, 40 x 80 ft. and 40 x 78 ft. garage on Knapp St. Estimated cost, $30,000. Auler & Jensen, F. R. A. Bldg., Archts.

WEST OF THE MISSISSIPPI

Col., Denver—The Denver & Salt Lake R.R., Ideal Bldg., will rebuild and equip its 90 x 250 ft. shops which were recently destroyed by fire. Estimated cost, $800,000. A. L. Cochran, Purch. Agt.

Minn., St. Paul—The Northern Pacific R. R., 507 Marquette Ave., plans to expend $644,121 for shop buildings, engine houses and appliances, $475,542 for shop machinery and tools, and $500,000 for pile drivers, cranes and like equipment.

CANADA

Man., Winnipeg—The Consolidated Motors Ltd., 397 Portage Ave., plans to build a garage. Estimated cost, $80,000.

Que., Montreal—The Canada Heaters Ltd., St. Laurent, plans to build a 1 story plant, here. Estimated cost, $250,000.

Que., Montreal—The Canadian Natl. Ry., Moncton, N. B., has awarded the contract for the construction of a 1 story, 100 x 250 ft. round house on Sherbrooke St., here. Estimated cost, $20,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Bridgeport—Dober & Klein, 693 Hallet St., have awarded the contract for the construction of a 1 story, 30 x 120 ft. bakery and 20 x 35 ft. garage, on Garden St. Estimated cost, $25,000.

Conn., South Glastonbury—The Wasuc Mills Co. plans to rebuild its paper plant which was recently destroyed by fire. Estimated cost, $50,000.

Conn., Versailles—The Federal Paper Board Co. has awarded the contract for altering and building a 2 story addition to its plant. Estimated cost, $250,000.

Mass., Boston—The Boston Herald, 171 Tremont St., has awarded the contract for the construction of a 4 story addition to its publishing plant on Avery St. Estimated cost, $125,000. Noted Oct. 28.

Mass., Boston—S. Simons, 21 Bromfield St., is having plans prepared for the construction of a 2 story, 30 x 50 ft. printing plant on Massachusetts Ave. Estimated cost, $25,000. M. J. Mastrangelo, 2 North Square, Archt.

Mass., Northampton—Tait Bros., Cass St., Springfield, plan to build a 1 story ice cream plant, here. Estimated cost, $25,000. B. E. Geckler, 335 St. James Ave., Archt.

Mass., Worcester—The J. F. Bicknell Lumber Co., 16 Mulberry St., has awarded the contract for the construction of a 2 story planing mill. Cost between $15,000 and $18,000.

Mass., Worcester—The P. W. Wood Lumber Corp., 7 Garden St., has awarded the contract for the construction of a 1 story, 36 x 48 ft. addition to its mill on Garden St. Estimated cost, $10,000.

R. I., Providence—The Rumford Chemical Wks., 231 South Main St., has awarded the contract for the construction of a 3 story, 58 x 125 ft. baking powder plant. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Red "C" Oil Mfg. Co., 410 Keyser Bldg., plans to build a refinery and tanks on Key Highway. Estimated cost, $250,000. W. W. Pagon, Lexington Bldg., Engr.

Md., Baltimore—The Horn Ice Cream Co., 446 Aisquith St., has awarded the contract for the construction of an ice cream and ice manufacturing plant on Low and Aisquith Sts. Estimated cost, $300,000. Noted Nov. 4.

N. Y., New York (Borough of Brooklyn)—The Hub Knitting Mills, 1007 Buchman Ave., will build a 1 story top addition and a 2 story side addition to its factory. Estimated cost, $50,000.

N. Y., New York (Borough of Queens)—J. H. Rhodes & Co., 115 Fulton St., New York City, has awarded the contract for the construction of a factory in Long Island City, for the manufacture of abrasives and polishing materials. Estimated cost, $200,000.

Pa., Philadelphia—The Amer. Ice Co., 6th and Arch Sts., has awarded the contract for the construction of a 2 story, 75 x 100 ft. ice factory on 10th and Callowhill Sts. Estimated cost, $120,000.

Pa., Philadelphia—L. Martin Co., Milnor St. south of Bleigh St., will build a 1 story, 27 x 47 x 55 ft. addition to its factory, for the manufacture of lampblack. Estimated cost, $25,000.

Pa., Philadelphia—The Westmoreland Color and Chemical Co., 22nd and Allegheny Sts., has awarded the contract for altering its factory. Estimated cost, $10,000.

Pa., Pittsburgh—The Methodist Episcopal Church, 6th and Smithfield Sts., had plans prepared for the construction of a 4 story, 50 x 100 ft. good will industrial building, on 28th St. and Liberty Ave. Cost, between $90,000 and $100,000. T. B. and L. Wolf, Century Bldg., Archts.

SOUTHERN STATES

La., New Orleans—The Linde Air Products Co., 30 East 42d St., New York City, will build a 1 story, 125 x 125 ft. oxygen factory, here. Estimated cost, $300,000.

MIDDLE WEST

Ill., Chicago—The Burns Craft Co., Como Bldg., has awarded the contract for the construction of a 1 story, 100 x 124 ft. factory at 2225-39 Hurden St. Estimated cost, $55,000.

Ill., Chicago—The New Way Laundry, Montrose and Francisco Sts., has awarded the contract for the construction of a 2 story, 64 x 152 ft. steam laundry. Estimated cost, $100,000. Noted Nov. 11.

Ill., Chicago—J. Press Sons, 300 North Halstead St., have awarded the contract for the construction of a 1 story, 125 x 140 ft. wagon factory at 3338-60 Normal Ave. Estimated cost, $150,000.

Mich., Saginaw—The Bd. Educ. is having plans prepared for the construction of a 3 story, 173 x 282 ft. school on Woodock and Park Sts. Plans include shops, etc. Estimated cost, $1,000,000. Cowles & Mutschellar, Chase Blk., Archts.

O., Cleveland—The Frank Dry Cleaning Co., 1361 East 55th St., plans to build a 2 story, 44 x 76 ft. factory at 6000 Bonna Ave. Estimated cost, $40,000. F. J. Cochlan, 709 Union Bldg., Archt.

O., Cleveland—F. Streiber, 10307 St. Clair Ave., has awarded the contract for the construction of a 1 story, 23 x 40 ft. bakery at 13707 St. Clair Ave. Estimated cost, $15,000.

O., Dayton—The Bd. Educ. plans to construct a 3 story, high school on Summit St. Plans include shops, etc. Estimated cost, $750,000. Schenk & Williams, Mutual Home Bldg., Archts.

O., Elyria—The Lakeshore Rubber Co., c/o H. L. Miller, Natl. City Bldg., Cleveland, has awarded the contract for the construction of a 2 story factory. Estimated cost, $150,000.

O., Willoughby—The Thor Tire Rubber Co., c/o R. C. Gary, 802 Society for Savings Bldg., Cleveland, plans to build a 1 and 3 story, 60 x 250 ft. factory and power plant. Estimated cost, $300,000. Private plans.

Wis., Fond du Lac—The Fond du Lac Paper Co., 298 Forest Ave., is having plans prepared for the construction of a 1 and 2 story, 100 x 300 ft. factory, for the manufacture of paper board. F. Stepnoski, 144 Marquette St., Archt. Noted Oct. 28.

Wis., Granville—The T. J. Moss Tie Co., Security Bldg., St. Louis, Mo., plans to construct a tie treating plant here, to include 3 buildings. Estimated cost, $100,000. J. Penny, c/o owner, Engr.

Wis., Hartford—The Storm King Mfg. Co. has acquired a site on North Main St., and plans to build a 2 story, 60 x 150 ft. factory, for the manufacture of side curtains for Ford cars. Estimated cost, $100,000.

Wis., Helenville—The Blochowiak Dairy Co., 1364 4th Ave., Milwaukee, plans to build a 2 story, 80 x 140 ft. dairy products factory on Main St., here. Estimated cost, $75,000.

Wis., Jefferson—The Jefferson Rubber Co. will build a 1 story, 80 x 300 ft. tire factory. Noted Oct. 28.

Wis., Madison—The Sheboygan Dairy Products Co., 936 North Water St., will soon award the contract for the construction of a 2 story, 70 x 140 ft. dairy products factory on West Wilson St., to replace the one which was recently destroyed by fire. Estimated cost, $75,000. Noted Oct. 28.

Wis., Manitowoc—The Drost Box Mfg. Co. 1116 South 9th St., has awarded the contract for the construction of the second unit of its plant on South 9th St., to be 3 story, 80 x 160 ft. Estimated cost, $75,000.

Wis., Milwaukee—The Hercules Knitting Co., 1097 Greenbush St., has awarded the contract for the construction of a 1 story, 30 x 80 ft. and 30 x 40 ft. addition to its factory. Estimated cost, $45,000.

Wis., Prentice—S. Millar Cold Storage Co., Marshfield, plans to build a 3 story, 50 x 80 ft. branch warehouse here. Estimated cost, $30,000.

Wis., Racine—The Bd. of Industrial Educ., City Hall, is having plans prepared for the construction of a 3 story, 85 x 186 ft. industrial school to include a manual training department, on Geneva St. Estimated cost, $250,000. A. A. Guilbert, Robinson Blk., Archt.

WEST OF THE MISSISSIPPI

Kan., Belleville—The Chicago, Rock Island & Pacific R.R., 139 West Van Buren St., Chicago, is having plans prepared for the construction of a 1 story, 32 x 80 ft. ice house here, to have a capacity of 1,500 tons. Estimated cost, $80,000. A. T. Hawk, c/o owner, Archt.

Mo., St. Louis—The Perfection Mfg. Co., Montgomery and Leffingwell Sts., will build a 1 story, 60 x 60 ft. enameling plant, at 2701 Leffingwell St. Estimated cost, $7,000. J. A. Eberle, Pres.

Mo., St. Louis—Smith & Davis Mfg. Co., 1925 Locust St., plans to build a furniture factory on Goodfellow Ave. Estimated cost, $1,000,000.

S. D., Watertown—The South Dakota Packing & Shipping Co. plans to build a 4 story packing house, to cover 80,000 cu.ft. of floor space. Estimated cost, $300,000. F. R. Hewitt, Pres.

Tex., Corpus Christi—W. A. Chambers will build an oil refinery, to have a capacity of 1,500 bbl. refined oil and gasoline per day. Estimated cost, $100,000.

CANADA

B. C., Powell River—The Powell River Co., Ltd., plans to build a saw mill, to have a daily capacity of 250,000 ft. Private plans.

B. C., Ruskin—The Ruskin Operations, Ltd., plans to build a second shingle unit to have a daily capacity of 1,000,000 shingles.

N. B., Glen Falls—Clarke Bros., Ltd., Bear River, plan to build a plant here for the manufacture of fibre shipping cases. Estimated cost, $50,000. Private plans.

N. F., Grand Falls—A. Rothermere will soon award the contract for the construction of an addition to his pulp and paper mill. Estimated cost, $180,000.

Ont., Coburg—The Rice Lake Canoe Co., Gore's Landing has awarded the contract for the construction of a factory here.

Ont., Hamilton—The United Gas & Fuel Co., 72 James St., N., plans to build a coke oven gas plant in the northeastern part of the city, near Stipe's Inlet. Estimated cost, $3,000,000.

Ont., Kingston—S. Kelley and S. Driver plan to build a moulding factory on Montreal St. Estimated cost, $35,000.

Ont., Mimico—The Sterling Action & Piano Key Co. has purchased a site on Church and Newcastle Sts. and plans to build a factory for the manufacture of musical accessories.

Que., Montreal—The Berliner Gramaphone Co. Ltd., 33 Lenoir St., has awarded the contract for the construction of a 1 story, 53 x 88 ft. gramaphone manufacturing plant on Lacarse St. Estimated cost, $75,000.

Que., Montreal—The Royal Duke Refining Co., 157 St. James St., plans to build a plant in Montreal East. Estimated cost, $200,000.

Que., Sherbrooke—The Sherbrooke Record Co., (printers and publishers), plans to build a 3 story, 50 x 75 ft. plant.

MEN——EQUIPMENT——SUPPLIES

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